Disclosure

This version of the Environmental and Social Impact Assessment (ESIA) of UAEL's 200 MW project at Ashuganj, Brahmanbaria, as prepared by AECOM India Private Ltd., is the only ESIA recognized by UAEL and is hereby approved for public disclosure.

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

200 MW THERMAL POWER PLANT, ASHUGANJ, BANGLADESH

FINAL REPORT

Submitted To

UNITED ASHUGANJ ENERGY LIMITED

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BANGLADESH

Submitted By

AECOM INDIA PRIVATE. LTD.

9TH FLOOR, INFINITY TOWER C,
DLF CYBERCITI,
DLF PHASE II, GURGAON,
INDIA 122002

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Abbreviations

AECL	Adroit Environment Consultants Ltd
AECOM	AECOM India Private Limited
AFCC	Ashuganj Fertilizer and Chemical Company
APSCL	Ashuganj Power Station Company Limited
AQ	Air Quality
ASA	Association for Social Advancement
AST	Above Storage Tanks
BADC	Bangladesh Agricultural Development Corporation
BAEC	Bangladesh Atomic Energy Commission
BDT	Bangladesh Taka
BERC	Bangladesh Energy Regulatory Commission
BFD	Bangladesh Forest Department
BMD	Bangladesh Meteorological Department
BNAAQS	Bangladesh National Ambient Air Quality Standards
BOD	Bio-chemical Oxygen Demand
BPDB	Bangladesh Power Development Board
BRAC	Bangladesh Rural Advancement Committee
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CCPP	Combined Cycle Power Plant
CP	Contracting Party
CRC	UN Convention on the Rights of the Child
CRC	Critically Endangered
CSO	Civil Society Organisations
CSR	Corporate Social Responsibility
DBL	Dhaka Bank Limited
DC	Deputy Commissioners
DD	Data Deficient
DL	Driver's License
DM	Demineralised
DO	Dissolved Oxygen
DoE	Department of Environment
DRS	District Regulating Station
E	Endangered
EA	Environmental Assessment
EC	Environmental Clearance
ECA	Environment Conservation Act
ECC	Emergency Control Centre
ECNWRC	Executive Committee of the National Water Resources Council
ECR	Environment Conservation Rules
EGCB	Electricity Generation Company of Bangladesh Ltd
EHS	Environment Health & Safety
EIA	Environment Impact Assessment
EMC	Environment Management Cell

EMP	Environment Management Plan
EPC	Engineering Procurement and Construction
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESIA	Environment and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMMP	Environmental and Social Management and Monitoring Plan
FEA	Fire and Explosion Analysis
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GHG	Green House Gas
GRC	Grievance Redressal Committee
GRM	Grievance Redressal Mechanism
HCl	Hydrocholric Acid
HCV	Heavy Commercial Vehicles
HH	Household
EHS	Environmental Health and Safety
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organisation
IPFF	Investment Promotion and Financing Facility
IPP	Independent Power Producers
LC	Least Concern
LCV	Light Commercial Vehicles
LDC	Less Developed Countries
LULC	Land Use and Land Cover
MEA	Multilateral Environmental Agreements
MMR	Maternal Mortality Ratio
MMSCFD	Million Standard Cubic Feet of gas per day
MoEF	Ministry of Environment and Forests
MOFL	Ministry of Fisheries and Livestock
MOLE	Ministry of Labour and Employment
MPEMR	Ministry of Power, Energy and Mineral Resources
MSL	Mean Sea Level
MW	Mega Watt
MWoCW	Ministry of Women and Child Welfare
MW	Megawatt
N	North
N/A	Not Applicable
NA	Not Assessed
NCL	Neptune Commercial Limited
NDA	Non Degraded Air shed
NFPA	National Fire Protection Agency
NGO	Non Governmental Organisations
NO_2	Nitrogen-di-Oxide
NOC	No Objection Certificate

NT	Near Threatened
NW	North West
NWMP	National Water Management Plan
NWPGCL	North West Power Generation Company Limited
NWRC	National Water Resources Council
NWRD	National Water Resources Database
OLTC	On Load Tap Charger
OP	Operational Policies
OPD	Out Patient
PFI	Participating Financial Institutions
PM	Particulate Matter
PPE	Personnel Protective Equipment
PS	Performance Standard
PSMP	Power System Master Plan
PUC	Pollution under Control
RC	Registration Certificate
REB	Rural Electrification Board
RMS	Regulation and Monitoring Station
RMS	Regulating & Metering Station
RPCL	Rural Power Company Limited
S	Southern
SAZ	Safe Assembly Zones
SE	South East
SO_2	Sulphur-di-Oxide
SOP	Standard Operating Procedures
SSKS	Satodal Samaj Kallyan Sangha
UAEL	United Ashuganj Energy Limited
UECL	United Enterprises & Co. Ltd.
UEPSL	United Engineering and Power Services Limited
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNICEF	United Nations International Child Relief Fund
UP	Union Parishads
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tanks
UTM	Universal Transverse Mercator
V	Vulnerable
W	West
WARPO	Water Resources and Planning Organisation
WB	World Bank
WD	Wind Direction
WHO	World Health Organisation
WHRB	Waste Heat Recovery Boilers

Executive Summary

To achieve the goals set out in the 'Vision 2021' document by the Government of Bangladesh, Ashuganj was foreseen as one of the best locations for sitting power plants. Most of the plants at Ashuganj are owned by Ashuganj Power Station Company Limited (APSCL) which is one of the subsidiaries of Bangladesh Power Development Board (BRBD). APSCL has a mandate to operate, maintain and develop the power generation capacity of Ashuganj Area. Under APSCL's flagship, three plants comprising a total capacity of 1125 MW are under construction. Apart from APSCL, there are four rental plants with a total contribution of approximately 250 MW power. Besides, the new 200 MW modular power plant, United Group has also been operating one of these gas fired quick rental power plants at Ashuganj since 2011.

The project (200 MW modular power plant) was awarded in 2013 to a collaboration 'United Ashuganj Energy Limited (UAEL)', which is jointly owned by United Enterprises & Co. Ltd (UECL) and APSCL with a share of 71% and 29% respectively. The construction of the project commenced in February, 2014 and completed in April, 2015. At present, the plant is operational and supplying power to the sub-station.

The project has obtained Environment Clearance (EC) from Department of Bangladesh in April, 2015. An Environment and Social Impact Assessment (ESIA) report was prepared by Adroit Environment Consultants Ltd. (AECL) to obtain the EC.

UAEL has approached Dhaka Bank Limited (DBL) for part financing which is one of the Participating Financial Institutions (PFI) under the World Bank (WB) supported Investment Promotion and Financing Facility (IPFF) Project. The WB has approved the project for financing, however, has put a condition to update the previous ESIA as per the WB requirements. AECOM India Private Limited (AECOM) was engaged to achieve this objective.

Project Description

The 200MW power plant is located in Sonarampur Village under Ashuganj Upazila in Brahmanbaria District. Due to the vicinity of the 'Ashuganj Hub' to the Titas Gas Field and location of the area on the banks of river Meghna, the Hub was selected as the suitable place for establishing the largest power plant of the country in 1966.

The construction of the power plants within the Hub commenced after obtaining land along the north-east side of the Meghna Railway Bridge. The land prior to the development of the Hub belonged to Bangladesh Railways which was transferred to APSCL for the purpose of setting up of power plants.

The power plants located inside APSCL have been developed in an area of 16.43 acres (66490 m^2) wherein an area of 6.48 acres has been provided to UAEL on lease. The 200 MW modular power plant is constructed over an area of 3.5 acres, while the remaining area is used as warehouses, which may be used in future for expansion purposes.

The 200 MW Combined Cycle Modular Power Plant is conceived with 20 Wartsila (34SG) gas engines generators of 9.73 MW each and one stream turbine of 16.1 MW(Triveni make). The Engineering, Procurement and Construction (EPC) of the plant was awarded to Neptune Commercial Limited (NCL), which is a sister concern of United Group. The project receives gas from the Bhakrabad Gas Distribution Company Limited (BGDCL) which is monitored through a Regulation and Monitoring Station (RMS).

Project Details

Gas Regulation and Monitoring System - The UAEL plant will utilise natural gas as fuel which will be supplied by BGDCL through its Direct Regulating Station (DRS) at Ashuganj. A dedicated 1 km long pipeline of diameter 10 inches is constructed to transport gas at 1000 psi to Regulating and Metering Station of capacity 50 MMSCFD at the site. Gas will be supplied to the engines through a 3 inch diameter pipeline at 70 psi from the RMS facility.

Reciprocating Engines - The plant has installed twenty gas engines of Wartsila make (W20V34SG) having power generation capacity of 9.73 MW each. The reciprocating engine uses reciprocating pistons to convert pressure into a rotating motion. The facility is based on spark ignition four stroke engine which is an internal combustion engine in which the pistons completes four separate stokes which constitute a single thermodynamic cycle.

ABB Alternator – Each of the gas engines is coupled with ABB alternators, providing a modular configuration to the plant and a greater flexibility in operation as well as maintaining uniform efficiency at variable load. Synchronous alternators engaged will generate electricity at 11 kV.

Waste Heat Recovery Boiler – There are 20 Waste Heat Recovery Boiler installed in the plant which is a single drum natural circulation type boiler where water is in tube side and flue gases on the shell side. The hot exhaust gases from the engines are supplied to the WHRB to produce steam at a rate of 4.12 tonnes per hour at 22 bar and 360oC.

Steam Turbine – The steam from all the 20 units is fed to the steam turbine coupled with alternator to generate 16.1 MW of power at 11 kV.

Condenser – The exhaust steam is taken to the condenser unit which has an open cycle cooling arrangement i.e. once through. Anticipated temperature increase in temperature across condenser is about 9.5^0C.

Power Evacuation – The power generated at the alternators is evacuated through four On Load Tap Changer (OLTC) power transformers (70/80 MVA, 11/230 kV). Further, four units of 1250 A, 40 kA, 230 kV, SF 6 breakers have been installed at the HT side. The auxiliary transformers have 630 A/1250 A, 50 kA, 11 kV SF 6 breakers. The UAEL sub-station supplies this power to 230 KV GIS substation of APSCL via four steel lattice towers each having height of 40 m.

DM Plant – A demineralised (DM) water treatment plant with 4 m^3/hr capacity is established to treat ground water to be used in the boilers. Ground water is extracted through a deep tube well at 10m^3/hr, which is stored at an underground RCC tank. Approximately, 4m^3/hr of treated water is produced through the process, which is stored at 20 kl DM tank. Out of the total 2.4 m^3/hr of DM

water will be utilised as make-up water to produce steam in the boilers. The rest will be utilised for consumption at the plant.

Greenbelt – As per conditions mentioned in the Environment Clearance, the plant is required to maintain 33% of its total area under Green Zone. Considering this, greenbelt has been proposed to be developed at the site which is yet to be undertaken by UAEL.

Storm Water Drains – Drains are provided all around the project site to collect all the storm water. On the West, the drain is about 500 mm wide and 250 mm deep and near the discharge point on the East, the depth of the drain increases to 900 mm. A slope of 1:500 is provided from West to East. The storm water is discharged to the open channel running across Ashuganj. The underground drains have been provided around the engine halls so as to avoid contamination of storm water and facilitate collection of all oily water in an underground tank.

Administrative Building – The administrative building is five storied where most of the staff will be accommodated. A canteen has also been provided on the third floor of the building. Provision of storage of lube oils and other chemicals have also been housed within the building.

Resource Required and Utilities

Project Land – The entire area of 'Ashuganj Hub' is owned by the Bangladesh Government and is the specific property of the Bangladesh Railways Authority which has been leased for a period of 99 years to APSCL. Upon awarding 200 MW project to UAEL, 6.48 acres of land has been leased to UAEL by APSCL along with all right of way. Prior to land transfer from Bangladesh Railways Authority to APSCL, it was reported that three (3) fishermen possessing valid fishing licenses used to undertake fishing activities on the said land. Bangladesh Railway Authorities by conducting consultations with the fishermen and verifying their licenses have paid each a compensation amount. Since then, the land was fenced and lying barren and unused before it was leased to UAEL.

Manpower - A total of 100 workers engaged with Neptune Commercial Limited were employed during the construction phase. Two (2) local contractors were also hired during construction, SBS Construction and Megha Consortium for the provision of construction material and manpower. A total of about 400 workers were engaged from SBS Construction (about 250 workers) and Megha Consortium (about 160 workers). The construction work has been completed. During the operational phase, a total of 140 workers are envisaged to be required at the plant.

Raw Material and Consumables – A total of 40 Million standard cubic feet of gas per day is required for the power generation. In addition, lubricating oil and coolants are required as consumables. The lube oil inside the engine is to be tested every 1000 running hour interval and depending upon the parameters the oil will be either sweetened or changed. UAEL plans to change the oil every 1600 running hour interval based on their previous experience. Quantity of lubricating oil required for the plant is estimated to be 341,640 litres per year. Quantity of coolant required for the plant is about 6000 litre per annum (240 packs of 25 l capacity), to be used in the closed loop cooling cycle in the reciprocating engines.

Water Demand – For the cooling purpose, 6000m3 of water is proposed to be sourced from River Meghna per hour i.e. 144, 000m3/d or 1.67m3/s. A barge mounted floating pump house has been

placed on the river Meghna to supply cooling water to the plant through a 600 m long pipeline having diameter of 1.2 m. For human consumption (i.e., kitchen, drinking and flushing) a total of 6.3 KLD of water is required considering per capita demand of 45 litres per day. Other demands like drinking water for daily labourers, make-up water for boiler and landscaping are met through groundwater. At present, 10.63 m3/hr of ground water is extracted through existing bore wells (two) at the site. The ground water is stored at a reservoir of 164 m3 capacity. After demineralised treatment 4m3/hr is available, out of which, 2.4m3/hr of demineralised water is utilised as make-up water to produce steam in the boilers and rest is utilised for consumption at the plant.

Wastewater Management – The cooling water mixed with reject from the DM plant (i.e., 6m3/hr) is discharged to an existing canal, at a distance of about 300 m east of the plant. This canal carries cooling water from other power plants and discharges the same to river Meghna. The quantity of municipal water generated at site will be 5 KLD which will be collected in a septic tank and only supernatant will be discharged to the drain passing near the plant site.

Solid Waste Management – The total municipal waste envisaged to be produced at site is estimated to be approximately 42 kg per day (300 g/day/person) which will include paper waste, packaging waste and food waste. Municipal waste will be collected by ASPCL waste management authority and is to be disposed off to the designated waste disposal area. Hazardous waste in the form of empty lube oil drums 91635 no. /year) and coolant packs (240 no. /year) will also be produced. This waste will be disposed off through government recognised vendor and records of the same are to be maintained at site.

Existing Baseline Environment of the Project Area

Baseline information was collated by review of previous EIA report, other published literatures, site surveys and primary monitoring carried out between March-April 2015 by Bangladesh Atomic Energy Commission (BAEC) and UAEL.

Site Setting – A 5 km radii 'study area' was studied for the existing landuse pattern. The study area is characterised by alluvium flood plain deposits. According to the Bangladesh Agricultural Research Council's Agro-Ecological Zoning map of Bangladesh, the project area falls in the Middle Meghna River Floodplain which includes the main channel of the Meghna upstream from its junction with the Dhaleshwari and Ganges as far as Bhairab Bazar. The floodplain of Meghna at this area occupies a low-lying landscape of broad islands and many broad meandering channels. The Meghna sediments are mainly silty and clayey and sandy Brahmaputra sediments are deposited at the surface on some ridges in the north.

Geomorphology Soil Types – Soils of the project area are non calcareous dark grey floodplain soils. These are seasonally flooded soils developed to below 25 cm, not very strongly acidic throughout the upper 50 cm and not calcareous within 125 cm from surface.

Hydrogeology - The aquifer type and characteristics of the Chittagong Coastal Plain in which the study area is located is semi confined to confined. Here the plains that exist in between the folded hill ranges in the east and coastline in the west is flat and plain. A 25 to 30 m thick zone of silt and clay covers the aquifer materials. This shallow aquifer is about 50 m deep. The District wise aquifer test analysis shows that transmissivity of aquifers in Brahmanbaria district ranges from 450-780

m2/day while permeability ranges from 8-23 m2/day. The ground water level in the project area is less than 5.3 m deep as it is located on the flood plain of river Meghna.

Hydrology - Ashuganj is situated on the left bank of river Meghna which is the main source of water for the nearby villages as well as the Hub. As per the available discharge data of river Meghna between 1998 and 2006, the lean flow generally varies between 2000 and 4500 m^3/s. At present, total water extraction from the river Meghna for all the ASPCL power plant is 39 m^3/s. The UAEL plant will require additional 1.67 m^3/s.

Tectonic Setup – The Bengal basin is formed due to the presence of an active Himalayan folded belt in the north and Indo-Burman belt in the east. It is surrounded by Archean Indian Platform in the west, Tertiary and in part, Mesozoic metamorphic Indo-Burman ranges in the east and the Archean basement of the Shillong Plateau in the north. The Eastern Folded belt extends S-N within Bangladesh for 450 km and is about 150 km wide, covering an area of 35000 km^2 of on-shore area. The location of Ashuganj lies within the eastern fold.

Natural Hazards: Seismicity and Floods- Bangladesh has been divided into three seismic zones wherein the northern region is categorised as Zone I (with seismic coefficient 0.08 g, corresponding to maximum intensity of IX on Mercalli scale) covering areas like Rangpur, Mymensingh and Sylhet. Zone II (with seismic coefficient 0.05 g, corresponding to maximum intensity of VIII) covers region of Dinajpur, Bogra, Dhaka and Chittagong. The southern part of the country is Zone III (with seismic coefficient 0.04 g, corresponding to maximum intensity of VII) and least susceptible to earthquakes. Considering the high risk of earthquakes, the plant has been designed for seismic Zone II. Ashuganj is located on the low lying flood plains of Meghna, thus making the area prone to monsoon and flash floods. The highest water level recorded at Brahmanbaria station at Upper Meghna is 7.78 m PWD. The plant has an elevation of approximately 11km over mean sea level.

Land Use Pattern – The Ministry of Land in its report on 'Land Zoning of Ashuganj Upazila' published in August 2011 mentions that the Ashuganj Union comprises of eight mouzas having a total area of 1133 hectares (ha), of which the net cultivable land is 765 ha (67%) and the other land use are urban area (9%), settlements with forests & gardens (12%) and water bodies (11%). The Ashuganj Union has been categorised as Agro-Urban and Commercial Zone. AECOM through the use of available satellite imagery have established the land use pattern of 5 km radii as the study area. The most predominant land use is agriculture which occupies 50% if the total area, 29% is under cultivation and approximately 21% is fallow. River and other water bodies occupy a total of 24% while industrial area occupies 5% of the total area. Barren land occupies 8% of the total land use.

Climate and Meteorology – Meteorological data for 10 years was assessed for climatic conditions. Bangladesh has a tropical monsoon climate with a distinct monsoon season during June-September, when the bulk of rainfall occurs. During pre-monsoon, high temperatures are observed in the entire country while from October onwards, temperature starts decreasing and months between December and February are marked by cool and dry weather. The annual rainfall varied between 1329 mm and 2885 mm during the last 10 years while the humidity was more that 65% and in monsoon months, the peak reaches as high as 82%. The monthly average temperature was recorded to be in the range of 17oC during January and 30oC during May and June. The monthly average wind speed varies from 2 knots to 6.3 knots in various months in the last 10 years.

Ambient Air Quality – A total of five parameters were sampled, such as, suspended particulate matter (SPM), PM10, PM2.5, CO and NO2 during March 2015. The SPM recorded at site ranges between 185 and 784 µg/m^3 which are higher than the WHO limit of 230 µg/m^3. The other two parameters of dust, PM10 and PM2.5 are higher than the BNAAQS and WHO standards. The concentrations of NO2 and CO are well within the limits provided by BNAAQS. The NO2 concentration varied between 0.072 to 0.098 mg/m^3 and CO is less than 5 mg/m^3.

Noise Quality – The noise monitoring was carried out at five locations within the plant boundaries between 5th and 31st March 2015. Noise level monitoring data is higher than the National Noise Level Standards (ECR 1997) of Industrial Area. This is due to Aggreko International Projects Ltd which is located adjacent to the plant area at the southern side and therefore the noise level was observed much higher than other monitoring sites of the project area during the monitoring periods.

Surface Water Quality –The surface water sample was collected on 20th April, 2015 from river Meghna and was sent to SGS Labs, Bangladesh for analysis. The recent monitoring results were compared with DoE Standards for inland surface water and it was found that water is suitable for all purposes except for drinking without treatment as the DO content is less than 6 mg/l. Metal content such as Arsenic, Cadmium, Chromium, Mercury, Lead and Zinc were also analysed to which the result produced were mentioned as not detectable.

Ground Water Quality –Ground water being the main source of water for domestic use in the area, samples were extracted from a tube well and existing bore well from the plant site on 5th May 2015. The results mentioned that all parameters analysed are in conformance with the allowable limit of drinking water as per the Bangladesh Standards for Drinking Water and WHO Guidelines. Total and faecal coliforms numbers were observed high in the ground water samples of the project site, suggesting faecal contamination. This might be due to the absence of drainage system, open defecation combined with easy percolation of contaminated water to the ground water which is available at shallow depths.

Soil – A soil sample from the project site was collected on 20th April 2015 and analysed by SGS Labs. As per the results, lead, chromium, copper in the soil sample is 8.7 mg/l, 43.94 mg/l and 71.31 mg/l respectively and mercury and cadmium were observed to be not detected. Potassium content was found to be 21621.0 mg/l.

Traffic Count – Traffic survey were undertaken at three locations of the project site covering Waqda Road and Dhaka-Sylhet Highway. The traffic count on Waqda Road indicates that 45% of non motorised vehicles, 28% of heavy commercial vehicles (HCV), 17% of light commercial vehicles (LCV), 3% of two wheelers and 7% of three wheelers contribute to the total traffic. While on Dhaka-Sylhet Highway, the maximum influx is observed is observed for three wheelers (47%) followed by HCV (27%) and LCV (25%) while non- motorised vehicles accounts to 1.3% of the total traffic.

Ecology – The natural vegetation of the surveyed area (5 km radii) is classified into barringtonia swamp forest, eastern wet alluvial grassland and primary seral. Nine sites were identified to provide a proportionate representation of the microhabitats and land use types. The identified modified habitats recorded were farmlands, habitations, embankments, roads, village ponds and dug wells and jetties. The survey-area contains natural habitats in the form of small communities or individuals

of native species distributed over patches of natural forest, marshes and natural water bodies. The survey area coincides with a globally important avian migratory flyway namely, the Brahmaputra river-system. No known legally protected or internationally recognised area is situated within or includes any part of the survey. The local communities depend on the survey area for water, cultivated foods, wild (uncultivated) foods, traditional medicines, fuel, fodder, fibre, timber and various secondary needs. Any loss, degradation or fragmentation of the habitats in and around the survey-area is likely to quantitatively and qualitatively degrade the ecosystem services provided by the survey-area to both, human and non-human organisms dependant on them.

Socio-Economic Baseline and Stakeholder Consultation

Socio Economic Profile – A 2 km radii was considered as the study area to establish the demographic and socio – economic conditions of the project influenced villages. A total of three villages (Sonarampur, Ashuganj & Char Sonarampur) under Ashuganj Union, one village, Char Chartala under Char Chartala Union, one village, Shohagpur under Durgapur Union and two villages (Bhairab Bazar and Paltakanda) under Bhairab Paurashava Union were considered for the study. Amongst the villages, Char Chartala has the highest population with 25,789 persons while Char Sonarampur has the least with population of just 1508 people. Ashuganj village has a relatively high proportion of 'floating population' (2.76%) most likely indicative of the rice mill workers living and working in the area. The mean household size for all villages is mostly between four (4) to six (6) persons per family, except for Shohagpur which has the highest proportion of families with eight (8) members. The largest proportion of population in the study area villages falls within the age groups of 15 to 59 years with Bhairab Bazar (62.7%) leading. The gender statistics of the Chittagong and Dhaka Divisions indicate that 30.8% and 40.9% of females within the age group of 15 – 19 years are married. This was a major reason contributing to the discontinuation of education amongst the females and high cases of complicated deliveries. In regards to sex ratio, Paltakanda has the least number of males per 100 females (97). All other villages have sex ratios that indicate more males than females.

In terms of literacy levels, Shohagpur has the highest literacy rate at 61.9% and the villages of Char Sonarampur and Paltakanda the least, with only 26.3% and 27.6%. Ashuganj Upazila and the villages under its administration have no recorded tribal population while Bhairab Upazila has 30 Lusai persons with 11 of them living in Bhairab Paurashava. All the project influenced villages have the highest proportion of their populations following Islam, with the exception of two villages, namely Char Sonarampur and Bhairab Bazar.

The highest proportion of population in the project influenced villages within the districts of Brahmanbaria and Kishoreganj are engaged in agriculture except for Char Sonarampur were fishing is the main activity. As per the survey undertaken, populations within the study area have been observed to be involved in fishing, agriculture, bamboo trading, rice mills and small businesses that have grown substantially in the last three years with the growth of 'Ashuganj Hub'. Of the total employable population in the entire study area, between 17 - 30 % that are currently unemployed, Shohagpur, the highest (30%) population. In terms of health profile, it was noted during the survey and consultation with a senior doctor at a prominent private hospital in Char Chartala that the most common ailments that the hospital saw as cases, were of fever (of unknown origin), urinary tract infections in both men and women, complications during child birth and dysentery. Water borne diseases were noted to be the most prevalent and the main cause of visits to Clinics and hospitals.

Majority of the households in the project influenced population live in self – owned houses and are not bound financially towards rent payments. The only exception is Ashuganj Village, where 82.5% of persons live in rented houses. This is probably due to the high number of migrant workers who live locally and work at the Ashuganj Hub. In regards to types of houses, most residents live in semi pucca (semi solid) and kuccha (mud house) house in the area, with the exception for Char Sonarampur wherein close to 89% lives in Kuccha houses. The most common source of water for domestic consumption comes from tube wells which are arsenic free. Most houses in rural areas within the project influenced region have either Sanitary (non water sealed) toilets or non sanitary toilets. There is regular supply of electricity in the project influenced area, with the sole exception of Char Sonarampur. The Ashuganj Upazilla has 1 Upazilla health complex, 2 union sub-centres, 5 family welfare centres and 9 community clinics while Bhairab Upazilla has 1 Upazilla health complex, 5 family welfare centres, 2 union sub-centres and a railways hospital. Both the Upazillas are well connected by roadways, waterways and railways. In close vicinity to the UAEL project site, there are 2 primary schools and 4 middle to senior schools all of which functional and fully staffed. All the project influenced villages have at least one primary school each, although Char Sonarampur's school is devoid of any furniture and lacks trained teachers. The nearest banking services for the villages that fall under Ashuganj Upazilla are in Ashuganj Bazaar area. It was reported during community consultations that there are a total of 20 banks, of which 6 are government owned.

Need Assessment - The needs assessment conducted during the survey revealed that healthcare was the major area which respondents from villages of Sonarampur, Ashuganj Bazar, Shohagpur, Paltakanda and Char Sonarampur stated needed priority. Char Sonarampur mentioned that electricity and poor transportation facilities were the major need of the hour. Education was also highlighted by respondents of Char Sonarampur and Shohagpur as areas which needed improvement. The community members of Sonarampur expressed the specific need for adult education facilities for women, further adding that there was a definitely a demand amongst women for the same. Pressure on the existing sanitation facilities were also stated as an area of concern amongst population within Char Chartola and Ashuganj.

Stakeholder Consultation – Stakeholder consultation were undertaken within the defined area of study. Stakeholders were identified and mapped as per their level of interest and influence towards the project. Two levels of engagement were focused upon when undertaking stakeholder consultations, namely, socio-economic survey and focus group discussions and one to one interviews. Consultations were undertaken with Non Governmental Organisation (NGOs) workers, opinion leaders, local government officials and professions like doctor, rice mill owners and small business owners. A public hearing of the project was undertaken on 22nd March 2014 at APSCL Complex by AECL.

Anticipated Environmental Impacts and Mitigation Measures

The project will comprise of twenty (20) gas engines, twenty (20) boilers, a steam turbine and a condenser and employ 140 persons during operations. As the plant is already in operation, impacts pertaining to construction phase have not been included. However, issues relating to land have been covered.

The anticipated impacts and mitigation measures during the pre-construction and operation phases have been provided below,

S.No.	Impacts Identified	Suggested Mitigation Measures
Pre-Construction Phase		
1	Land	No pending issues
Operation Phase		
1	Land and Soil	• All hazardous waste collected at site shall be disposed off within a defined time period • Segregate hazardous waste at generation point and store at a confined and designated area • Storage of waste lube drums shall have restricted access • The lube storage area needs to be provided with secondary containment and trap to control contamination of runoffs. • Dustbins of good and long-lasting quality should be installed at different places to collect organic, plastic, glass and other garbage separately. • All workers shall be instructed to put garbage in designated bins as per segregation. • Metals, plastics, paper and glasses in the garbage shall be sold to vendors for recycling. • No open burning of waste shall be carried out at the site.
2	Water Resources and Water Quality	• UAEL shall provide one toilet each for every 15 male and 10 female workers. • No waste water shall be disposed off outside the plant at any point of time. • The septic tank should be cleaned regularly and disposed off adequately. • Groundwater must be metered and record of extraction must be maintained at site. • Surface runoff from oil handling areas/devices shall be treated for oil separation before being discharged. • Strom water drains must be cleaned every year before monsoon.
3	Ambient Air Quality	• UAEL shall undertake regular maintenance and upkeep of engines to ensure good thermal efficiency • UAEL shall undertake Quarterly monitoring of stacks to ensure that the emissions are within the requisite limits • UAEL shall also undertake ambient air quality monitoring to verify compliance with the National standards and commitments with the lender
4	Ambient Noise Quality	• Normal working hours of the worker in the high noise area shall be restricted to 4 hours only. • Workers working near high noise generation shall be provided with ear plugs/ ear muffs to limit exposure to occupational hazards. • Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components shall be conducted. • All enclosures shall be well maintained and keep closed at all times
5	Ecology	• To compensate the loss of flora and improve environmental quality, green belt along the project site boundary shall be developed. A total of 33% will be reserved for green area. • Native species shall be selected and healthy seedlings be planted at intervals of 4 × 4-m in 60 × 60 × 60-cm size pits filled with topsoil. • Attempts shall be made to ensure that all open spaces, where tree plantation may not possible will be covered with shrubs and grass to prevent erosion of topsoil. • In addition, trees/ saplings shall be planted in nearby areas beyond the project site in consultation with Forest Department.
6	Socio-	• UAEL shall make provisions to include screening of workers for certain

S.No.	Impacts Identified	Suggested Mitigation Measures
	Economic	infectious diseases as per government or WHO protocol. • The workforce shall be provided with health promotion strategies and basic information on transmission of common infectious diseases. Where in needed, the company should collaborate with the local health department and provide measures to prevent or contain and outbreak of diseases. • UAEL shall continue to ensure that all important routes and passages used by the community are unaffected at all times. If a temporary blockage is anticipated, the community must be informed prior to its blockage, signage should be put up and an alternate route provided. In addition, at no juncture must an important community resource such as a mosque, tube wells etc be affected without the community's prior consent. • UAEL shall ensure adequate waste management measures to prevent any unhygienic conditions around the plant which may lead to vector borne diseases. • The community shall be informed of all major developments prior to each development in the plant, through notices and announcements, as advised in the Stakeholder Engagement Plan. • To avoid any communal discord, all sections of the community, except the economically weak, shall be provided with equal preference where in CSR measures and employment is concerned. Economically vulnerable groups such as the Rice mill workers and fishing community shall be provided a special focus in the CSR plans, to ensure contribution towards their upliftment.
7	Traffic and Transport	• Dedicated parking area shall be provided within the project site. No trucks shall be parked outside the plant • The speed limit of vehicles shall be restricted to 25 km/hr on internal roads and populated areas • In case of breakdown, provisions shall be made for quick retrieval of vehicles • Drivers shall be provided with training for safe driving. • Signage shall be provided in the plant and immediate access road to facilitate traffic movement and parking • All drivers shall be trained and evaluated in defensive and off-road vehicle operations. • Inventory of the vehicles used in project along with their Pollution control documents, Driver's Licence (DL) and Registration Certificate (RC) shall be maintained
8	Occupation Health and Safety	• Instructions and procedures shall be provided to all the workers • Safety belt and safety nets shall be used while working at height • All works related to working at heights shall be undertaken during the daytime when sufficient sunlight is available • A work permit system for all works related to working at heights (typically when working over 2m and above) and for hot jobs shall be implemented; • Prior to executing any work the integrity of the structures shall be inspected • Only trained workers in climbing techniques and the use of fall protection measures, inspection, maintenance and replacement of fall protection equipment shall be engaged to work at heights • Health and safety training shall be given on regular basis to all the employees • All safety incidents shall be recorded and monitored with the objective of attaining zero incidences of mishaps • Access to areas containing exposed electrical equipment shall be enclosed and posted with warning signs • Workers involved in electric operations shall be provided with Personnel Protective Equipment (PPE) such as rubber gloves etc; • Employees involved in electrical works shall be trained in and familiar with the

S.No.	Impacts Identified	Suggested Mitigation Measures
		safety-related work practices, safety procedures, and other safety requirements pertaining to their respective job assignments. • Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment shall be maintained in good working order and be readily accessible. It shall be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. • Provision of manual firefighting equipment that is easily accessible and simple to use • Fire and emergency alarm systems that are both audible and visible • Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization; • Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components shall be undertaken • Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work shall be performed on or proximal to them • Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training shall include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tagout procedures, first aid including CPR, and proper rescue procedures.
Decommissioning Phase		
1	Impacts due to removal of infrastructure and reclamation of the project site	• UAEL shall prepare a detailed decommissioning plan at least one year prior to the commencement of decommissioning • Inform the community and relevant stakeholders about decommissioning plan and proposed subsequent actions; • Removal of all structures including foundations to the extent possible; • Removal of all waste collected at site, including the demolition debris; • Noise and dust emissions to be kept low during the decommissioning; • Roads to be retained after consultation with the community; and • Heavy vehicle movement to be planned and informed to the community.

Analysis of Alternatives

The analysis of alternatives considered for the proposed project is no project scenario, siting criteria, alternative technologies and alternative design. Due to increase in demand of electricity and pressure on supply of electricity, the project will assist in meeting the projections and visions of the Government of Bangladesh in achieving more than 7% projected GDP growth of the country.

The plant is located inside Ashuganj Power Plant Complex at a distance of 400 m from river Meghna and the topography of the area is flat and terrain well developed area filled with sand. There are no ecological sensitive areas within 5 km of the study area.

BGDCL RMS already exists in APSCL which will supply natural gas through pipelines to the proposed project. Ashuganj Complex is located near Titas Gas Field at a distance of 1km, on left bank of Meghna River and the supply of natural gas will be economical through pipelines.

The 6.48 acres of land for the project site forms part of Ashuganj Complex and was not being used by villagers for any economic activities once the area was fenced after it was leased by APSCL from

Bangladesh Railway Authority. Low pollution levels are expected from the project due to the stack height, the technology used and the temperature of water discharge.

The combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50% more electricity from the same fuel than a traditional simple-cycle plant.

Environment and Social Management Plan

An Environment and Social Management Plan has been suggested to mitigate the identified adverse environmental and social impacts and associated risks with the project.

An Environmental and Social Monitoring Plan has also been suggested to assess the compliance with respect environmental and social measures and standards in order to comply with the environmental regulation and abide to environmental standards.

For the effective and consistent functioning of the project, an Environment and Social Management Cell (ESMC) will be established for the project. During the operation phase, this Cell will include staff from the site and corporate office of UECL. The overall management of the project will be undertaken through coordination between UECL corporate office and project site team. The activities will be managed through Plant Manager who will be supported by the Safety Incharge and Environmental and Social Officer. The Plant Manager will coordinate with Environment and Social team at corporate level.

Records of solid waste handling and disposal, regulatory licenses, aspects relating to monitoring and survey, social, accidental reporting and others shall be maintained by the Site Management.

Risk Assessment

To identify quantitative hazard, an ALOHA analysis of the fuel gas used for the gas turbine has been provided for the power project of UAEL. Two scenarios were assessed for potential industrial accidents related to gas flow. In the first scenario, flammable area vapour cloud and blast area were modelled while in the second scenario, thermal radiation threat zone providing the affects and lethal nature of the explosion has been modelled.

To effectively control the pipeline route, UAEL shall put in place a blanket ban on smoking and ensure adequate monitoring of pipeline from time to time for corrosion or damage. The thick green belt proposed will help to mitigate the radiation intensity level outside the plant boundary. In addition, measures for fire- fighting arrangements have also been provided in case of fire emergency.

Disaster Management Plan

A Disaster Management Plan to identify potential foreseeable accidents/emergency situations has been developed for UAEL. The Plan will be applicable to all project related activities associated with the construction and operation phases of the Project. The elements of the Plan will be directly implemented by the contractors and their sub-contractors, with UAEL having overall management and responsibility.

An Emergency Response Team has been suggested to handle different emergencies and manage any emergency situation. The team will be headed by the Site Incident Controller and will comprise of fire/safety officer, evacuation officer, communication officer and medical officer. The team will maintain all records relating to incident/accident occurring in the project area.

An Emergency Control Center will be the focal point in case of an emergency from where the overall operations to handle the emergency are directed and coordinated. This center is to be located outside the area of potential hazard and shall be easily approachable.

Disclosure and Grievance Redressal

UAEL has undertaken a public hearing within the complex of APSCL, Ashuganj on 22nd March 2014 wherein notices of the public hearing were advertised on 13th March 2014 in two national newspapers, one, The Dhaka Tribune and second, The Daily Samakal. Besides these notices, announcements and information were extended to the local communities residing within the vicinity of the project site, NGOs working in the area, opinion leaders and local governing units via discussions held during the socio-economic survey exercise and focus group discussions.

A summary of the draft EIA report and Executive Summary have been translated in the local language (Bangla) and uploaded on UAEL's website for public viewing. UAEL is further required to publicise the report in a public place in Ashuganj (e.g. Ashuganj Union Parishad Office) by translating the report in local language for the common understanding of the local population.

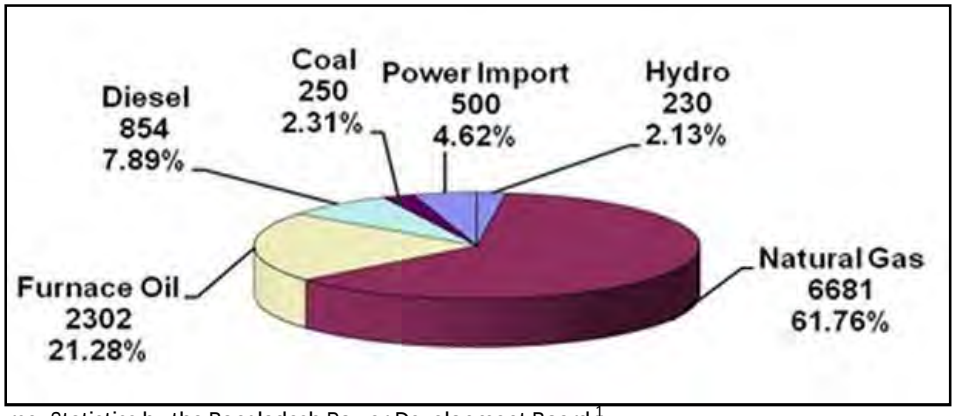
A Grievance Redressal Committee (GRC) has been developed at the Site Level wherein to realize the elements of transparency and accountability, the Chairman of Ashuganj Union Parishad has been nominated as the Chair Person of the Committee. In addition, a proposed Grievance Redressal Mechanism structure has been developed for UAEL for redressal of all cases of grievances along with the resources required for the implementation of the grievances.

1. INTRODUCTION

1.1 Project Background

The 'Vision 2021' document of Government of Bangladesh has identified uninterrupted power supply all over Bangladesh in next 15 years as one of the goals. In order to achieve this goal, a total of 24,000 MW of power will be required by 2021 (Power System Master Plan, 2010). At present, the total installed capacity of the country is about 10,817 MW with maximum generation of 7,500 MW (Bangladesh Power Development Board, 2015). Out of the total installed capacity, the government has a share of 54 % and rest is contributed by private sector. Natural gas is still the most relied source of power generation in Bangladesh as the country has good gas reserves. Natural gas constitutes a significant percentage of the fuel utilised for power generation (Figure 1-1).

Figure 1-1: Installed Capacity by Fuel Type in MW, as on January, 2015



Source: Statistics by the Bangladesh Power Development Board [1]

In order to take advantage of the gas fields, Ashuganj was foreseen as one of the best locations for sitting power plants (Figure 1-2). The first power plant of 128 MW comprising of two units of 64 MW each was commissioned at Ashuganj in the year 1970. Since then the capacity augmentation continued and currently Ashuganj has a total installed capacity of 1027 MW, generating about 780 MW (Figure 1-2). Ashuganj Power Station Company Limited (APSCL) owns most of the plants at Ashuganj, which is one of the subsidiaries of Bangladesh Power Development Board (BPDB). APSCL has a mandate to operate, maintain and develop the power generation capacity of Ashuganj Area. Under APSCL's flagship, three more plants of capacity 1125 MW are under construction.

Apart from APSCL, there are four rental plants with a contribution of approximately 250 MW of power. United Group has also been operating one of these natural gas fired quick rental power plants at Ashuganj since 2011.

The project under consideration was awarded to United Ashuganj Energy Limited (UAEL) is jointly owned by United Enterprises & Co. Ltd. (UECL) and APSCL with a share of 71% and 29% respectively. The project was awarded to UAEL in January 2013 and construction of the project commenced in

[1] http://www.bpdb.gov.bd/bpdb/index.php?option=com_content&view=article&id=5&Itemid=6

February, 2014. The project has obtained Environment Clearance from Department of Bangladesh in April, 2015. The plant is operational since 8th May 2015 and supplying power to the sub-station.

Figure 1-2: Location of the Ashuganj in Bangladesh

Table 1-1: Current and Future Power Plants at Ashuganj

S. No.	Name	Commissioning date	Capacity, MW	De-rated Capacity, MW
Current installations				
1	Un it 1	1970	64	-
2	Unit 2	1970	64	64
3	Unit 3	1986	150	105
4	Unit 4	1987	150	140
5	Unit 5	1988	150	140
6	Gas Turbine 1	1982	56	-
7	Gas Turbine 2	1986	56	40
8	Steam Turbine	1984	34	-
9	Gas Engine, Site 2	2011	53	53
10	Aggreko - Rental	2014	95	90
11	Precision Power - Rental	2013	55	55
12	Midland Power - Rental	2014	50	50
13	United Ashuganj Power Ltd. - Rental	2011	53	50
	Total		1027	787
Future Expansion				
1	Compined Cycle Power Plant, CCPP (North)		450	
2	Compined Cycle Power Plant (South)		450	
3	Compined Cycle Power Plant		225	

Source: Power Generation Development Plan-2012, APSCL

1.2 Need of the Study

The UAEL has approached Dhaka Bank Limited (DBL) for part financing. DBL is one of the Participating Financial Institutions (PFI) under the World Bank (WB) supported Investment Promotion and Financing Facility (IPFF) Project. The WB has already approved the project for financing but has provided a condition to prepare an Environmental and Social Impact Assessment (ESIA) report as per the WB requirements.

An EIA report prepared by Adroit Environment Consultants Ltd (AECL) to obtain environment clearance was reviewed by the WB experts and it was decided that an update considering the Environmental and Social Safeguard Policies of WB was required to be added to the report. In order to achieve the objective AECOM India Private Limited (AECOM) has been engaged to prepare an ESIA report as per the WB Operational Policies (OP 4.01 and others as applicable) and EHS (Environmental Health and Safety) guidelines.

1.3 Objective and Scope of the Study

The objective of the assignment is to prepare an ESIA report compliant with the requirements of the WB Operational Policies (OP 4.01 and others as applicable) and EHS guidelines, as per IPFF Project and to prepare a compliance monitoring report for construction and early operation phase of the plant.

The brief scope of the work is as the following:

- Preparation of an ESIA document compliant to the due diligence requirements of the IPFF including collection and testing of data from the site.
- Indicate whether or not any of the WB's environmental and social safeguard policies, e.g., OP 4.12 on Involuntary Resettlement and OP 4.10 on Indigenous Peoples will be triggered by the project and if it does an ESMP shall be prepared.
- Address comments provided by the WB team and the third party review on a previous documents, which were used by UAEL and
- Preparation of a report on compliance of environmental due diligence in the project implementation to date.

1.4 Approach and Methodology of the Study

The environmental and social assessment has been carried out against the following reference framework:

- Applicable national and local regulatory requirements
- World Bank Operational Policies -Environmental Assessment (OP 4.01), Natural Habitats (OP 4.04), Pest Management (OP 4.09), Indigenous Peoples (OP 4.10), Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP 4.12), Forests (OP 4.36) and Projects in Disputed Areas (OP 7.60)
- Equator Principles, June 2013
- World Bank Group's General EHS Guidelines
- World Bank Group's EHS Guidelines for Thermal Power Plant

An area of 2 km radius around the project site was considered as the "Study Area". Reconnaissance surveys and stakeholder consultations were conducted to identify environmental and social issues in the project area. Furthermore, detailed desk based literature study was also undertaken and relevant information was collected about the project and site.

- The report has utilised baseline data collected for the earlier EIA Report, which is further substantiated with the additional monitoring for Air, Noise, Water, Soil and Traffic. In addition, land use assessment was also carried out using satellite imagery.
- A detailed ecological survey was undertaken for the entire study area to assess biodiversity, species richness and abundance. Social surveys and stakeholder consultations were also conducted by AECOM, wherein the project-influenced villages were visited to collect information on the socio-economic and demographic aspects of the local communities. Representatives of various government departments and non-government agencies were contacted to gather information relevant to the project and the project area.
- Finally, based on the baseline and proposed activities, an impact analyses was carried out wherein potential direct and indirect impacts of the project activities have been considered. A detailed Environmental and Social Management and Monitoring Plan (ESMMP), has been formulated for the project where measures are proposed to mitigate adverse impacts, along with recommended good practices.

Along with this ESIA, an Environment, Health, Safety and Social Due Diligence (EHSSDD) report is also prepared to ascertain the environmental and social compliance of the project in accordance with the requirements of the World Bank group and national legislations. All the observations reported by the Mott MacDonald in their Initial Environmental and Social Compliance Review of November 2012 were also considered to assess if any corrective measures have been taken to resolve the non-compliance.

1.5 Limitations

The ESIA study for the Project is largely based on the project specific details as provided by UAEL, discussions with community and observations from the site visits and surveys conducted. Data on air, water, soil and noise presented in baseline chapter is either provided by the client or cited from earlier ESIA report prepared by AECL in 2014 for the same project.

Professional judgement and subjective interpretation of facts has been applied for this study based on the available data and information.

1.6 Report Layout

The EIA report comprises of the following sections:

- Chapter 1 provides project back ground along with Scope and Methodology of the study.
- Chapter 2 describes the National laws, policies, standards and World Bank guidelines applicable for the project.
- Chapter 3 provides a description of the project site and details the project activities and components.

- Chapter 4 reports the environmental and ecological conditions prevailing in the study area of the proposed project.
- Chapter 5 focuses on the socio-economic conditions within the study area and discusses finding of the stakeholder consultations.
- Chapter 6 details the impacts of the project activities along with the mitigation measure.
- Chapter 7 provides the analyses of alternative.
- Chapter 8 presents Environmental Management Plan (EMP) detailing all mitigation measures, monitoring requirements, roles and responsibility for EMP implementation.
- Chapter 9 and 10 details the Risk Assessment and Emergency Response Plan proposed for the site.
- Chapter 11 provides disclosure and grievance redress mechanism.

2. LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

This chapter provides a description of the regulatory framework applicable to the 200 MW Gas Fired Modular Combined Cycle Power Plant located at Ashuganj, Brahmanbaria. It highlights environmental, health & safety and social regulations with applicable permits and standards relevant to the project. It broadly focuses on the:

- Legal Enforcement Agencies at National Level
- Applicable national and local Environmental and Social Laws, Regulations and Policies
- World Bank Environmental and Social Safeguard Policies
- World Bank Environmental Impact Assessment Guidelines
- International & National Environment Standards/ Guidelines
- Applicable International Conventions/Protocols.

2.1 Legal Enforcement Agencies

The responsibility of formulation, implementation and modification of national level environmental laws in Bangladesh lies with the Department of Environment (DoE). The DoE was established under the Environmental Pollution Control Ordinance, 1977 and it functions under the Ministry of Environment and Forests (MoEF). It is responsible for implementation of the provisions of the Environment Conservation Act, 1995 as amended till 2010 (hereinafter referred as ECA) which is the umbrella legislation regulating environmental issues in the country. A brief description of the relevant legal relevant enforcement agencies has been described in the Table 2-1.

Table 2-1: Relevant legal enforcement agencies and their functions

S. No.	Agency	Functions
1.	The Ministry of Environment & Forests (MoEF)	The MoEF is the nodal agency in the administrative structure of the Central Government, for the planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. It oversees all environmental matters in the country and is a permanent member of the Executive Committee of the National Economic Council. It plays a pivotal role as a participant of the United Nations Environment Programme (UNEP). Its principal activities include: • Conservation & survey of flora, fauna, forests and wildlife; • Prevention and control of pollution; and • Forestation & regeneration of degraded areas and protection of environment in the frame work of legislations.
2.	The Department of Environment (DoE)	An Environment Pollution Control Board was setup under the Environment Pollution Control Ordinance, 1977. It underwent a series of subsequent restructuring and was finally renamed as Department of Environment in 1989. It is headed by a Director General appointed by the Government. The DoE through its head, divisional and district level offices conducts the following principal activities : • Advising the Government to avoid such manufacturing processes, commodities and substances which are likely to cause environmental pollution; • Advisory and issuing directions to the concerned person regarding the environmentally sound use, storage, transportation, import and export of a hazardous substance or its components;

S. No.	Agency	Functions
		• Conducting inquiries and research activities on conservation, improvement and pollution of the environment and rendering assistance to any other authority/organisation regarding the same; • Collection and publication of information about environmental pollution; • Conducting programs for observation of drinking water quality and issuing directives if necessary for adherence to drinking water quality standards; • Formulation of environmental guidelines; • Prescribing and modifying environmental quality standards pertaining to air, water, noise, vehicular emissions etc.; • Issuing Location Clearance and Environmental Clearance Certificates to projects for all categories; and • Implementation of provisions of ECA and rules made there under.
3.	The Bangladesh Forest Department (BFD)	It was established under the MoEF and is responsible for identifying and declaring of certain areas as reserved or protected or private forest lands. It implements the provisions of Forest Act, 1927 and National Forestry Policy, 1994. It is also responsible for wildlife preservation and protection through implementation of Wildlife (Preservation & Security) Act, 2012.
4.	The Water Resources and Planning Organisation (WARPO)	It was established under the Water Resources Planning Act, 1992. Its core functions include: • Monitoring the implementation of National Water Management Plan (NWMP); • Upkeep of water resource assessments; • Maintenance, updating and dissemination of the National Water Resources Database (NWRD) and MIS; • Secretariat to the National Water Resources Council (NWRC) and the Executive Committee of the National Water Resources Council (ECNWRC); • Responding to the NWRC/ECNWRC requests for information and advice; • Periodic update of the NWMP; • Assisting other agencies in planning, monitoring, studies and investigations; • Advice on policy, strategy, institutional and legal issues; • Laying down effluent discharge standards into river in consultation with DoE; and • Special studies and research as required.
5.	The Bangladesh Inland Water Transport Authority (BIWTA)	It was setup in 1958 under the provisions of East Pakistan Inland water Transport Authority Ordinance 1958. Its specific functions include: • Carry out river conservancy works; • Disseminate navigational and meteorological information including publication of river charts; • Draw up programmers of dredging requirements and priorities for efficient maintenance of existing navigable waterways and for resuscitation of dead or dying rivers, channels, or canals, including development of new channels and canals for navigation; and • Develop, maintain and operate inland river ports, landing/ferry ghats[2] and terminal facilities in such ports or ghats.
6.	The Ministry of Fisheries and Livestock (MOFL)	The main functions of the MOFL include: • Preservation of fisheries resources; • Fulfilling the requirement of animal protein through proper management and planned development; • Increasing socio-economic conditions of fishermen • Creating employment opportunities for rural unemployed and landless people • Expanding foreign exchange earnings by exporting fish and fishery products; • Developing innovative technologies through research for fisheries development and preservation; and

[2] The colloquial term for area leading down to a river.

S. No.	Agency	Functions
		• Protection of fishes through implementation of Protection and Conservation of Fish Act, 1950 as amended till date.
7.	The Bangladesh Power Development Board (BPDB)	It is a statutory body created in May 1, 1972 and is responsible for major portion of generation and distribution of electricity mainly in urban areas except Dhaka and West Zone of the country. It has undertaken a massive capacity expansion plan to add about 10500 MW generation capacities in next 5 years to achieve 24000 MW capacity according to Power System Master Plan (PSMP) by 2021.
8.	The Bangladesh Energy Regulatory Commission (BERC)	It was established under the Bangladesh Energy Regulatory Commission Act, 2003. Some of its key functions include: • Issue, cancel, amend and determine conditions of licenses, exemption of licenses and determine the conditions to be followed by such exempted persons; • Regulation of generation, storage, supply, and transmission of energy; • Determine tariff for electricity distribution etc.; • Ensure control of environmental standard of energy under existing laws; • Extend co-operation and advice to the Government, if necessary, regarding electricity generation, transmission, marketing, supply, distribution and storage of energy.
9.	The Ministry of Power, Energy and Mineral Resources (MPEMR)	The MPEMR was setup with vision of providing access to affordable and reliable electricity to the entire country by the year 2021. The major functions of the ministry include: • Coordinating activities related to power generation, transmission and distribution; • Managing all matters and policies related to the power sector; • Expand, rehabilitate and modernize power generation, transmission and distribution services in line with the increasing national demand and prepare action plans and programs accordingly; • Encourage private and joint venture in power sector besides government investment; • Monitor revenue earnings and commercial activities of utilities; and • Promotion of renewable energy and energy efficiency through formulation of policy/regulation, different incentive mechanism and Research and Development.
10.	The Ministry of Labour and Employment (MOLE)	It was established with following objectives: • Creation of employment opportunity; • Creation of semi-skilled and skilled manpower; • Enhancement of productivity of factories by creating friendly working environment between workers & employers; • Ensuring welfare of workers in different industrial areas; • Implementation of labour laws; • Fixing up minimum wages of labour; and • Ensuring justice through Labour Court.
11.	The Ministry of Land	The ministry of land is in charge of land administration, management and development for the overall growth of the nation. The Ministry manages Government owned lands, vested properties and abandoned properties. It is responsible for the collection of land development tax, land surveying and record keeping and updating. Land Acquisition and requisition fall under the responsibilities of this ministry.
12.	The Ministry of Social Welfare	The Ministry of Welfare is responsible for formulating policies and implementing programmes towards the benefit of the vulnerable and disadvantaged sections of the society. These include destitute, juveniles, abandoned, orphans, poor amongst the mentally and physically handicapped, and the poorest amongst the economically weak.
13.	The Ministry	The Ministry of Health and Family Welfare oversees three main aspects, these

S. No.	Agency	Functions
	of Health and Family Welfare	being Public Health, Medical Education and Health services. The ministry is in charge of formulating and implementing public health programmes such as child immunization, preventive disease – surveillance, DOTS, Polio control etc. It is also entrusted with the duty of regulating health care resources including medical practitioners, and laying guidelines for health services in the country.
14.	Union Parishads	Union Parishads (UP) are elected statutory local government body for the rural Bangladesh. A UP consists of a Chairman and twelve members. Each UP has a full-time Secretary, appointed by the Deputy Commissioner (DC). The functions of UP are: • Maintenance of law and order and conduction of censuses of all kinds. • Registration of births, deaths, blind people, beggars and destitute. • Planning and implementation of development schemes in the field of agriculture, forestry, fisheries, livestock, education, health, small and micro enterprises, communications, irrigation and flood control. • Protection and maintenance of public property such as roads, bridges, canals, embankments, markets, telephones and electricity lines.

2.2 Applicable Environmental and Social Laws, Regulations and Policies

The relevant National Policies, Acts and Rules pertaining to the project have been summarised in Table 2-2 and Table 2-3.

Table 2-2: Applicable National Level Policies

National Environment Policy, 1992 and Action Plan
It sets out the framework for establishment of legislations related to 15 sectors including environment, water, agriculture, water resources development, forest and wildlife, fisheries etc. MOEF and DOE are responsible for enforcement of clauses as prescribed in the policy and action plan. The key provisions of the policy are: • Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) of all new public and private sector industrial projects is mandatory • Adoption of corrective measures by polluting industries in phases. • Prevention of land erosion, and environmentally sound management of newly accreted land. • Conservation of wildlife, bio-diversity, forest, fisheries and livestock. Applicability to the Project UAEL should ensure that project activities comply with the provisions made under the policy and the legislations made there under for implementing the same.
National Industrial Policy, 2010
The policy aims to ensure the industrialization process is compliant with internationally agreed environment, health, and safety and labour standards. The government will ensure assistance for creating alternative employment, keeping the socio-economic backdrop in mind, for any privatization proposal. This policy is enforced by Ministries of Industries, Bangladesh. Applicability to the Project UAEL should ensure that project activities comply with the provisions made under the policy and the legislations made there under for implementing the same.
Investment Board Act (1989)
Board of Investment (BOI), established under this act, is the principal private investment promotion and facilitation agency of Bangladesh. Under the provision of this act as per *Schedule 11,* all industries established in non-governmental sectors licensed by the Board shall be registered. As per Schedule 15 of this act, any industrial undertaking licensed transgresses any provision of this Act or of any rule made there under or breaks any condition relating to the licence, the Board may cancel the licence of the industrial undertaking. The BOI holds the responsibility for enforcement of this act.

Applicability to the Project
UAEL shall ensure that the proposed project proponent is registered as prescribed by the Act.

National Water Policy 1999

Water Resource Planning Organisation (WARPO) is the key agency for enforcement of provisions as laid in the policy. The WARPO shall:

- Establish zoning regulations for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities ;
- Establish standards for effluent disposal into common water courses in consultation with DoE; and
- The effluent disposal will be monitored regularly by relevant Government agencies in order to prevent water pollution.

Applicability to the Project
UAEL shall ensure that the project effluent disposal meets the prescribed quality standards set down by the DoE, which has also been prescribed in Schedule-9 "*Standards for Sewage Discharge*" and Schedule- 10 "*Standards for Waste from Industrial Units*" of ECR Rules, 1997.

National Water Management Plan, 2001 *(Approved in 2004)*

Water Resource Planning Organisation (WARPO) is the key agency for enforcement of provisions as laid in the Management Plan. The objectives of the Plan are listed below:

- To operationalize directives given in National Water Policy and to do in accordance with the Government approved Development Strategy;
- To address issues related to harnessing and development of all forms of surface and ground water and management of these resources in an efficient and equitable manner; and
- Consultation and participation with the direct beneficiaries in the hand over and development of water schemes.

Applicability to the Project
UAEL should abide to the directives given in National Water Policy, as applicable. UAEL should also ensure that a structured drainage system for the project is constructed to avoid any drainage congestion. Groundwater sources are to be used optimally so as to stop decline in water levels of the area.

The National Fisheries Policy, 1999

The policy broadly aims at fisheries development, regulation of aquaculture, biodiversity conservation and formulation of laws to ban the disposal of any untreated industrial effluents into the water bodies. Ministry of Fisheries and Livestock (MoFL) and Department of Fisheries (DoF) hold the responsibility for implementing the provisions as laid in the policy. The objectives of the fisheries policy are:

- Enhancement of the fisheries production;
- Poverty alleviation through creation of self-employment and improvement of socio-economic conditions of the fishermen;
- Fulfilling the demand for animal protein;
- Achieve economic growth through earning foreign currency by exporting fish and fisheries products; and
- Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities.

Applicability to the Project
UAEL shall ensure that during project operation, no untreated effluent is disposed into the river. The treated effluent shall also meet the standards stipulated under the ECR and treated sewage shall be chlorinated before its final discharge.

National Child Labour Elimination Policy 2010

The National Child Labour Elimination Policy 2010 has been adopted to provide a framework towards eradicating all forms of child labour by 2015. The policy defines and lays guidelines for underage workers, regulation of their working hours, wages, nutrition needs, mental health, education and overall work environment. As per the policy, a child is a person under the age of 14. A person between the ages of 14 and 18 is an adolescent, and should be granted special amendments, if compelled to work due to poor economic status. The policy also entails that a child may not be employed as a regular employee, not be made to work in hazardous settings, provided breaks more frequent than those for regular employees and have enough time left for study. Ministry of Labour and Employment (MoLE) and Ministry of Women and Child Welfare (MWoCW) are the key agencies for implementation of the clauses as described in the policy.

Applicability to the Project
During all stages concerning employment of labour, UAEL should take the policy as a guidance document for following ethical practices at workplace, in dealing with adolescent workers, if at all.

Table 2-3: Applicable Environment, Health & Safety and Social Acts and Rules

The Environment Conservation Act, 1995 *as amended till October 5, 2010 (hereinafter referred as ECA)*
The ECA is currently the main legislation relating to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. The main focuses of the Act can be summarized as: • Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA); • Regulations in respect of vehicles emitting smoke harmful for the environment; • Environmental clearance (EC) ; • Regulation of industries and other development activities' discharge permits; • Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes; • Promulgation of a standard limit for discharging and emitting waste; and • Formulation and declaration of environmental guidelines. Applicability to the Project The project has received EC in April, 2015. UAEL should ensure that the Project will be undertaken in line with the aims and objectives of the Act by conserving the environment and controlling and mitigating potential impacts.
The Environment Conservation Rules, 1997 *as amended till February 16, 2002(hereinafter referred as ECR)*
MoEF and DoE are the key agencies responsible for enforcement of provisions as prescribed under the rules. The provisions under the ECR are summarised as follows: • The industries for the purpose of obtaining ECC have been classified into the following 4 categories based on their site and impact on the environment: i. Green ii. Orange –A iii. Orange – B iv. Red *The list of industries falling under each category has been annexed in the Schedule – I to the ECR.* • For proposed industries falling under the Orange A&B and Red categories, a Location Clearance Certificate (LCC) needs to be obtained from DoE prior to the issuance of ECC. • The project entrepreneur shall apply for ECC in Form 3 along with prescribed documents and application fees. • ECC (for Red category) will be valid for 1 year from the issuance date and shall be renewed at least 30 days prior to expiry. • Various environmental quality standards pertaining to air, water, sound, odour etc. have been laid down in the schedules attached to the Act. • Emissions and waste discharge standards have been laid down in Schedules 9-11. The person in charge of facility/unit shall notify the Director General, DoE in case of pollutant emission/ discharge in excess of prescribed standards or where there is a possibility of the same. Applicability to the Project As per the requirements of the Act the following clearances have been sought: • No Objection Certificate: issued by Ashuganj Union Parishad, dated 12th November, 2013 (Annexure I). • Site Clearance Certificate: issued by DoE, Chittagong Division, dated 24th, February, 2014 vide Memo No-cA/Pwe/Clearance- 07/2014/67 (Annexure II). • EIA Report Approval: issued by DoE, Chittagong Division, dated 15th May, 2014 vide Memo No-PaA/chaB/Charpatra/ - 07/2014/158 (Annexure III). • Environmental Clearance: issued by DoE, Brahamanbaria, dated 2nd April, 2015 vide Memo No- (Annexure IV).

UAEL shall ensure that all the conditions given in these clearances are abided and timely renewal of EC is taken up.

Ground Water Management Ordinance 1985

As per the provisions prescribed in schedule 5 of this act, No tube well shall be installed in any place without a licence granted by the Upazila Parishad. In addition, no application shall be entertained by the Upazila Parishad unless it is accompanied by such fee as may be prescribed under the requirements of this ordinance.

Applicability to the Project

APSCL has leased the land to APSCL with all its rights, which includes rights for groundwater extraction. UAEL has also received a NoC for Ashuganj Union Parishad, which does not have any condition or observation on groundwater extraction.

Protection and Conservation of Fish Act, 1950 *as amended through February 16, 1995*

This Act was promulgated for conservation of fish in Bangladesh and their protection against indiscriminate fishing, poisoning due to industrial effluent disposal into the water, oil spills etc.

Applicability to the Project

UAEL should ensure that fishes are protected during intake of water from Meghna River. Suitable screens and meshes are installed to avoid capturing of fishes with the intake water. It is estimated that 1.67 m^3/sec of river water would be drawn from the intake of UAEL 200 MW power project discharged at 7^0C rise in river temperature may not have any significant impact on river water temperature considering the flow of the river Meghna.

Bangladesh Water Act, 2013

- A National Water Resources Council (NWRC) to be established for implementing the provisions of the Act
- A National Water Policy shall be adopted by the Council addressing the following issues:
  i. Purpose and sectors of water use
  ii. Affordability of water users
  iii. Actual cost of water abstraction and distribution
  iv. Financial ability and backwardness of water users of any group thereof
  v. Water demand and supply
  vi. Any other issues considered relevant by GoB
- An Executive Committee of the Council shall be established or ensuring efficient performance of the Council.
- The GoB can declare certain areas as Water Stress Areas for the protection of water sources or aquifers.
- Water zone demarcation (industrial, agricultural, brackish water aquaculture and hatchery water zones) through gazette notification and issuance of protection order for efficient water management in such zones
- Declaration of flood control zone and its management.
- Restriction on abstraction of total water from any water source.

Applicability to the Project

This Act was implemented in 2013 and the NWRC and Executive Committee are yet to be formulated. Upon formation of the aforementioned bodies, water stress areas and related provisions may be prescribed. UAEL shall comply with the following:

- UAEL shall ensure that it has appropriate water right for extraction of water from Meghna River for cooling purposes;
- UAEL may apply to an authority designated by the government to have a water use, which is permissible, declared to be an existing lawful water use;
- UAEL shall ensure that water use must be licensed by the authorities empowered under existing laws and in accordance with the standards set by the Ministry of Water Resources;
- UAEL shall ensure that waste treatment, pollution control and monitoring equipment to be installed, maintained and operated as per the specifications;
- UAEL shall ensure that area from where water will be extracted does not fall under water stress areas of Meghna River;
- UAEL to ensure a person may not drill, construct, enlarge or otherwise alter a borehole, engage in a borehole drilling program, for the purpose of exploring for ground water, except in accordance with the standards set by the Ministry of Water Resources; and

- UAEL shall ensure that ground water is not contaminated by means and develop proper drainage channels around the proposed plant;
- UAEL shall ensure compliance with legal requirements as mentioned under Chapter XI 'General Provisions" if applicable.

Protection and Conservation of Fish Act, 1950 *as amended through February 16, 1995*

This Act was promulgated for conservation of fish in Bangladesh and their protection against indiscriminate fishing, poisoning due to industrial effluent disposal into the water, oil spills etc.

Applicability to the Project

UAEL should ensure that fishes are protected during intake of water from Meghna River. Suitable screens and meshes are installed to avoid capturing of fishes with the intake water. It is estimated that 1.67 m^3/sec of river water would be drawn from the intake of UAEL 200 MW power project discharged at 70C rise in river temperature may not have any significant impact on river water temperature considering the flow of the river.

Protection and Conservation of Fish Rules, 1985

The Rules were prescribed under the provisions of Protection and Conservation of Fish Act. It provides the regulations for prohibition of fishing during certain periods, licences for catching fishes, prevention of fish destruction due to explosives and industrial effluent disposal etc. Ministry of Environment and Forests, Bangladesh and Department of Fisheries are the departments responsible for implementation of clauses prescribed in the above said rules.

Applicability to the Project

UAEL shall ensure that untreated effluent is not disposed into the river. The treated effluent shall comply with the discharge standards stipulated under the ECR, 1997.

Bangladesh Energy Regulatory Commission Act, 2003 *(as amended in 2010)*

As per *section 27* of this act, no person shall engage himself in activities like power generation, energy transmission, and energy supply and energy storage, without a license from Bangladesh Energy Regulatory Commission (BERC), which has been constituted under this Act for its implementation.

Applicability to the Project

UAEL has also applied and received a license from BERC dated 26th April, 2015 with no.: BERC/POWER/IPP-026/L/035(Part-1)/1474 (Annexure V). The certificate is valid from 26th April, 2015 to 25th April, 2016.

The Building and Construction Act, 1952

- As per Section 3A of this act, No owner or occupier of a building shall, without obtaining previous permission from the Authorized Officer or the Committee use the building for the purpose other than that mentioned in the sanction.
- All the construction, re-construction works to be undertaken as per terms or conditions prescribed.

Applicability to the Project

All the construction work is completed at site. It was informed by the client that all guidelines and regulations were followed during the construction period.

The Vehicle Act, 1927

Bangladesh Road Transport Authority is the nodal agency for enforcement of clauses prescribed in the act. The key features of the act are:

- As per section 4 of this act, no owner or person in charge of a vehicle shall allow any person under the age of eighteen years to drive the same in any public place.
- As per section 7, no person shall drive a vehicle in a public place unless he is licensed in the prescribed manner.
- Every vehicle must possess a valid registration certificate as per section 11 of this act.

Applicability to the Project

UAEL shall ensure that every vehicle engaged for the project possess a certification of registration as required under this act.

The Motor Vehicle Ordinance Act, 1983 *(as modified on November, 1990)*

Bangladesh Road Transport Authority holds the responsibility for implementation of clauses as prescribed under various sections of the above said act.

- As per section 3 of the ordinance, no person shall drive a motor vehicle in any public place unless he holds an effective driving licence.

- No person under the age of eighteen years shall drive a motor vehicle in any public place.

Applicability to the Project
UAEL shall ensure that all the drivers engaged for its activities have a valid license.

Fatal Accidents Act, 1855

This Act was promulgated to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. The company will be liable to pay compensation in case of death of any worker/employee or damages in case death has not ensued but such circumstances could have resulted in death. Ministry of Labour and Employment (MoLE) is the key department which helps in implementation of clauses prescribed in this act.

Applicability to the Project
UAEL shall ensure compliance to the Rules.
UAEL should include the clauses pertaining to the above mentioned act in the Health and Safety Plan that has been developed. UAEL's HR Policy describes some elements pertaining to the provisions in case of a person met with an accident. The same can be elaborated with inclusion of clauses from the aforementioned act.

The Factories Act, 1965

This Act deals with the provisions for workers who are continuously working in any premises. Chief Inspector of the area is responsible for implementation of various clauses as prescribed in the act. The various related chapters are:

- Chapter III: Health and Hygiene -This chapter encompasses cleanliness, disposal of wastes and effluents, ventilation conditions of premises of a factory. There shall be enough provisions of lightning, drinking water and sanitation facilities. Sufficient number of spittoons shall also be maintained in a clean and hygienic condition.
- Chapter IV: Safety - Premises of a factory should be equipped with sufficient fire-fighting provisions, aggress and egress. Every moving machine (a motor or rotary convertor) should be fenced. No young person shall work at any machine unless he has been fully instructed as to the dangers arising in connection with the machine.
- Chapter V: Welfare- Adequate and suitable facilities for washing, bathing and first aid services should be available in the premises. Provisions for food to be served should be available for more than two hundred and fifty workers in a factory.
- Chapter VI: Working Hours of Adults - Working hours should be defined in a factory which should not be more than forty-eight hours in a week. No adult worker shall be required or allowed to work in any factory on a Sunday or a Friday. A notice of periods of work for adults showing clearly the periods which adult workers may be required to work to be displaced.

Applicability to the Project
UAEL shall ensure compliance with the clauses stipulated in the abovementioned act. UAEL being the occupier at least fifteen days before occupying or using any premises as a factory send to the Chief Inspector a written notice, containing items as mentioned in Section 6 of the act.

Bangladesh Labour Act, 2006 *(as amended through July 22, 2013)*

This Act consolidates and amends the laws relating to employment of labour, relations between workers and employers, determination of minimum wages, payment of wages and compensation for injuries to workers, formation of trade unions, rising and settlement of industrial disputes, health, safety, welfare and working conditions of workers, apprenticeship and matters connected therewith. The provisions prescribed under chapters pertaining to labour benefits and entitlements are as follows:

- Conditions of Service and Employment;
- Employment of Adolescent;
- Maternity Benefit;
- Working Hours and Leave;
- Wages and Payment;
- Workmen's Compensation for Injury by Accidents; and
- Trade Unions and Industrial Relations

Applicability to the Project
UAEL shall ensure that all conditions provided in the Act, pertaining to wages, health, hygiene safety and

welfare are met in accordance with the amended act.
Children's Act, 2013 (Act No. 24 of 2013)
The Act implements the Nation's ratification to the UN Convention on the Rights of the Child (CRC), and replaces The Children's Act of 1974. Ministry of Social Welfare, Ministry of Law, Justice and Parliamentary Affairs hold the various responsibilities for enactment of various clauses pertaining to welfare of children. The main components of the act are as follows: • The Act changes the legal definition of a child from being a person under the age of 14 to one under the age of 18. • It enforces the national authorities to establish Child Welfare Boards in each district, besides one at the national level. • It criminalizes any kind of cruelty inflicted on children while they are working in both the formal and informal sectors. Applicability to the Project UAEL must ensure that at through all stages of construction and operation, no juvenile (children between ages 14 and 18) are engaged on site.
The Acquisition and Requisition of Immovable Property Ordinance, 1982
The ordinance consolidates and amends the laws relating to acquisition and requisition of immovable property by the government. It lays down the procedures and conditions for acquisition of land and other immovable properties such as common property resources (wells, places of worship, burial grounds etc). As per Section 8 of this ordinance, the amount of compensation to be determined taking into consideration market value and decision of Deputy Commissioner. Ministry of Land, Bangladesh has the responsibility to overhaul the implementation of various clauses as prescribed in this act. Applicability to the Project The proposed project is envisaged to be built up on 6.48 acre of land which is located inside Ashuganj Power Plant Complex. No private land for this project was acquired. There will no physical displacement due to the project.
Prevention of Malaria (Special Provisions) Ordinance, 1978
Section 3 of the ordinance highlights the following points, relevant to industries, factories and commercial establishments. • The government may prohibit or order closure of anything to do with engineering, agricultural and industrial projects which may increase the extent and spread of malaria; • In such a case, the government may order the spraying of insecticide and prohibit the management from washing, white-washing, plastering, painting or applying any other surface treatment during a period of 5 months from spraying, with respect to any building or other premises which has been sprayed; • The government may authorise a person on its behalf to conduct arbitrary inspections and subsequently take measures to prevent or stop the spread of mosquito larvae; and • Measures may include collection of water and blood samples, spraying of insecticide and compulsory testing of migrant labour (from malaria endemic areas) for malaria. Applicability to the Project UAEL shall ensure the respective measures have been taken for prevention of malaria. As per section of the ordinance, the various measures can be but not restricted to: • Spraying of buildings and other premises with insecticides; • Medical examination of workers and manpower during construction and operation phase of the project; • Suitable onsite treatment of persons suffering or suspected to be suffering from malaria.

2.3 World Bank Environmental and Social Safeguard Policies

The World Bank Group (WBG) follows an operational policy statement (updated in February 2011), which stipulates that all operations are carried out in an environmentally responsible manner and that projects must comply with all local environment legal obligations and appropriate World Bank

guidelines3. The World Bank sets out its procedures and policies with regard to conducting environmental assessments on Operational Policy 4.01: Environmental Assessment (October 1991) and its updates and other pertinent Guidelines, which has been latest revised on April,2013. World Bank Environmental and Social Safeguard Policies provide ten (10) potential issues that need to be considered in an ESIA, depending on the specific characteristics of each project. Table 2-4 summarizes the expected applicability of the safeguard Policies for 200MW Gas Based Combined Cycle Power Plant.

Table 2-4: Applicable WB Policies

World Bank Safeguard- Environment Assessment (OP4.01)
The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. Applicability to the Project The project has received EC based on the EIA study by DoE in April, 2015. The report was not found satisfactorily addressing the WB policies and guidelines. Hence, this present report is prepared to undertake an assessment considering scale and potential environmental impact of the proposed project. All environmental and social aspects included in the proposed project are adequately examined and presented in this report.
World Bank Safeguard- Natural Habitats (OP/BP 4 .04)
The Bank requires borrowers to incorporate into their development and environmental strategies analyses of any major natural habitat issues, including identification of important natural habitat sites, the ecological functions they perform, the degree of threat to the sites, priorities for conservation, and associated recurrent-funding and capacity-building needs. World Bank does not support projects which involve significant conversion or degradation of critical habitats. Applicability to the Project The plant is located within Ashuganj the bank of river Meghna, which is about 400 m away from the site. River Meghna is abode to various small and large species of fishes. Water will be sourced from the river at 1.67 m^3 per second for UAEL and same quantity of hot will be discharged at temperature 7^0C higher than the river water temperature. Considering the lean flow of the river, i.e., 3000 m^3/s, the extraction and hot water discharge may not have any significant impact on river.
World Bank Safeguard- Pest Management (OP 4.09)
In appraising a project that will involve pest management, the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. As necessary, the Bank and the borrower incorporate in the project components to strengthen such capacity. Applicability to the Project It is a gas fired modular power plant and hence no activity is envisaged which can attract pests. Hence this policy is not relevant to the project.
World Bank Safeguard- Involuntary Resettlement(OP 4.12)
World Bank recognizes that Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. Applicability to the Project The land required for the project, which is 6.48 acre, has been leased from APSCL, which is located inside Ashuganj Power Plant Complex. The plant will not involve any relocation of human settlement. This policy is not applicable to the project.
World Bank Safeguard- Indigenous People(OP 4.10)
The Bank recognizes that the identities and cultures of Indigenous Peoples are inextricably linked to the lands on which they live and the natural resources on which they depend. Hence, A project proposed for Bank

[3] The following World Bank Group Environment, Health and Safety (EHS) Guidelines are expected to apply to the proposed project: WBG General EHS Guidelines and Guidelines for Thermal Power Plants. The guidelines are available at www.ifc.org/ehsguidelines

financing must be screened for presence of indigenous people. Applicability to the Project Census records and public consultations indicate that there are no Indigenous populations within a 2km radius of the project site. This policy is not applicable to the project.
World Bank Safeguard- Forests(OP 4.36)
If a project involves significant conversion or degradation of natural forests or related natural habitats that the Bank determines are not critical, and the Bank determines that there are no feasible alternatives to the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs; the Bank may finance the project provided that it incorporates appropriate mitigation measures. Applicability to the Project The proposed project does not involve any forest land and no forest land is observed with in 2 km radius of the project. Hence, this policy is not applicable.
World Bank Safeguard -Physical Cultural Resources(OP 4.11)
The borrower needs to addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process. Applicability to the Project As mentioned earlier the project is within the designated power plant area. No cultural heritage site is found within the area.
World Bank Safeguard - Project in Disputed Areas (OP 7.60)
Projects in Disputed Areas may affect the relations between the Bank and its borrowers, and between the claimants to the disputed area. Therefore, the Bank will only finance projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when the special circumstances of the case support Bank financing, notwithstanding the objection. Applicability to the Project The proposed project is not situated in a disputed area and this policy is not evoked.
World Bank Safeguard- Projects on International Waterways(OP 7.50)
The Bank recognizes that the cooperation and goodwill of riparians is essential for the efficient use and protection of the waterway. Therefore, it attaches great importance to riparians' making appropriate agreements or arrangements for these purposes for the entire waterway or any part thereof. Applicability to the Project The proposed project is situated in the Ashuganj area of Brahamanbaria district of Bangladesh. Entire project is within the Bangladesh and does not involve any international waterways. Thus, this policy is not applicable to the project.

2.4 World Bank's Categorization of the project

The Bank screens the Private Sector Activity in order to determine the nature and extent of the environmental and social assessment needed, based on the type, location, sensitivity, and scale of the activity, as well as the nature and magnitude of its potential impacts. This screening also identifies any additional information required to complete the Bank's environmental and social review and determine whether to support the activity. The Private Sector Activity is categorized by the Bank as Category A, B, C, depending on the nature of the activity and financing mechanism, as follows:

Table 2-5: World Bank's Categorization for Projects

Category	Justification
Category A	Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented;

Category	Justification
Category B	Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures;
Category C	Business activities with minimal or no adverse environmental or social risks and/or impacts;
Category FI	Business activities that involve investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The proposed project is classified as a Category A as per the Bank's categorization system considering the environmental impacts on water resource and quality, air and noise quality, hazard potential. The project have no resettlement & rehabilitation issues involved as the land is leased on long term from APSCL.

2.5 EHS Guidelines of World Bank Group

These guidelines ensure that the projects are developed in a manner that is socially responsible and reflects sound environmental management practices. EHS considerations into the site selection and plant design processes should be considered in order to maximize the range of options available to prevent and control potential negative impacts.

1. Environmental, Health, and Safety General Guidelines;
2. Environmental, Health, and Safety Guidelines for Thermal Power Plants;

The key requirements stated in the EHS guidelines have been discussed in Table 2-6.

Table 2-6: Key Requirements as per EHS Guidelines of World Bank Group, Thermal Power Plants

S.N	Relevant Requirements as Stated in EHS Guidelines
1.	Air Emissions
i	Choice of fuel
a.	Selection of the best power generation technology
b.	Designing stack heights according to Good International Industry Practice (GIIP)
c.	Emissions should not contribute more than 25% of the applicable ambient air quality standards in the same air shed[4]
ii	Pollutant-specific control recommendations
b.	Nitrogen Oxides
a.	Use of low NOx burners with other combustion modifications, such as low excess air (LEA) firing
b.	Use of a selective catalytic reduction (SCR) system
c.	Use of water injection or SCR for combustion turbines and reciprocating engines burning liquid fuels;
d.	Use of lean-burn concept or SCR for new gas engines.
c.	Particulate Matter
a.	Installation of dust controls capable of over 99% removal efficiency, such as Electrostatic Precipitators, Fabric Filters (bag houses) or Wet Scrubbers.
b.	Use of loading and unloading equipment that minimizes the height of fuel drop to the stockpile
c.	Use of water spray systems for solid fuel storage in arid environments;
d.	Use of enclosed conveyors with well designed, extraction and filtration equipment on conveyor transfer points to prevent the emission of dust;
e.	Design and operate transport systems to minimize the generation and transport of dust on site;
2.	Energy efficiency and Greenhouse Gas emissions

[4] *An airshed should be considered as having poor air quality if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly.*

S.N	Relevant Requirements as Stated in EHS Guidelines
a.	Consider efficiency-relevant trade-offs between capital and operating costs involved in the use of different technologies.
b.	Use of high performance monitoring and process control techniques,
c.	Good design and maintenance of the combustion system
d.	Reforestation, afforestation, or capture and storage of CO_2 or other currently experimental options
e.	Robust Quality assurance on input material and Scheduled maintenance programs
f.	Insulate all steam, condensate, hot water and thermal fluid distribution pipe work, down to and including 1" (25 mm) diameter pipe, in addition to insulating all hot valves and flanges
g.	Ensure adequate insulation to reduce heat gains through cooling system structure and to below-ambient temperature refrigerant pipes and vessels.
3.	Water consumption and aquatic habitat alteration
a.	Reduction of maximum through-screen design intake velocity to 0.5 ft/s
b.	For freshwater rivers or streams intake flow should be sufficient to maintain resource use (i.e., irrigation and fisheries) as well as biodiversity during annual mean low flow conditions.
c.	Reduction of impingement and entrainment of fish and shellfish by the installation of technologies such as barrier nets (seasonal or year-round), fish handling and return systems, fine mesh screens, wedge wire screens, and aquatic filter barrier systems.
d.	Designing the location of the intake structure in a different direction or further out into the water body may also reduce impingement and entrainment
4.	Effluents
i.	Thermal Discharges
a.	integrity of the water body as a whole or endanger sensitive areas (such as recreational areas, breeding grounds, or areas with sensitive biota) to be maintained
b.	There should be no lethality or significant impact to breeding and feeding habits of organisms passing through the elevated temperature areas;
c.	No significant risk to human health or the environment due to the elevated temperature or residual levels of water treatment chemicals
d.	Adjustment of the discharge temperature, flow, outfall location, and outfall design to minimize impacts to acceptable level.
ii.	Liquid Waste
A	Treatment of low-volume wastewater streams that are typically collected in the boiler and turbine room sumps
b.	Pre-treatment of cooling tower makeup water
c.	installation of automated bleed/feed controllers in cooling towers
d.	use of inert construction materials to reduce chemical treatment requirements for cooling towers;
e.	Elimination of metals such as chromium and zinc from chemical additives used to control scaling and corrosion in cooling towers;
f.	Use the minimum required quantities of chlorinated biocides in place of brominated biocides.
g.	Process modification, including waste minimization, and reducing the use of hazardous materials.
h.	Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater
i.	Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone.
j.	Storm water should be separated from process and sanitary wastewater streams
k.	The parameters selected for monitoring should be indicative of the pollutants of concern from the process, and should include parameters that are regulated under compliance requirements;
l.	Limiting condenser or cooling tower blow down to the minimum required to prevent unacceptable accumulation of dissolved solids
iii.	Sanitary Wastewater
a.	Segregation of wastewater streams to ensure compatibility with selected treatment option.
b.	Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements
5.	Solid wastes
a.	Reuse of sludge from treatment of waste waters
6.	Hazardous materials and oil

S.N	Relevant Requirements as Stated in EHS Guidelines
i.	Release Prevention and Control Planning
a.	The use of double-walled, underground pressurized tanks for storage of pure liquefied ammonia (e.g., for use as reagent for SCR)
b.	Training of operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training
c.	Implementation of inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, piping systems, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and associated process equipment.
d.	Preparation of written Standard Operating Procedures (SOPs) for filling Underground Storage Tanks (USTs), Above Storage Tanks (ASTs) or other containers.
e.	SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall.
f.	Identification of locations of hazardous materials and associated activities on an emergency plan site map
g.	Documentation of availability of specific personal protective equipment and training needed to respond to an emergency
h.	Description of response activities in the event of a spill, release, or other chemical emergency
i.	Written process safety parameters (i.e., hazards of the chemical substances, safety equipment specifications, safe operation ranges for temperature, pressure, and other applicable parameters, evaluation of the consequences of deviations, etc.)
ii	Reaction, Fire, and Explosion Prevention
a.	Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas
b.	Provision of material-specific storage for extremely hazardous or reactive materials
c.	Use of flame arresting devices on vents from flammable storage containers
d.	Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials
e.	Selection of materials of construction compatible with products stored for all parts of storage and delivery systems, and avoiding reuse of tanks for different products without checking material compatibility
f.	Prohibition of all sources of ignition from areas near flammable storage tanks
g.	Appropriate secondary containment structures consist of berms, dikes, or walls capable of containing the 110 % of the largest tank or 25% of the combined tank volumes.
h.	An Emergency Preparedness and Response Plan incorporated into and consistent with, the facility's overall management system should be prepared
i.	A system for community awareness, notification and involvement that should be commensurate with the potential risks identified for the project to be incorporated.
7.	Noise
a.	Siting new facilities with consideration of distances from the noise sources to the receptors (e.g., residential receptors, schools, hospitals, religious places) to the extent possible
b.	Use of noise control techniques such as: using acoustic machine enclosures; selecting structures according to their noise isolation effect to envelop the building; using mufflers or silencers in intake and exhaust channels; using sound-absorptive materials in walls and ceilings; using vibration isolators and flexible connections (e.g., helical steel springs and rubber elements);
c.	Applying a carefully detailed design to prevent possible noise leakage through openings or to minimize pressure variations in piping;
d.	Modification of the plant configuration or use of noise barriers such as berms and vegetation to limit ambient noise at plant property lines.
e.	Identify and mark high noise areas and require that personal noise protecting gear is used all the time when working in such high noise areas (typically areas with noise levels >85 dBA).
f.	Noise monitoring may be carried out for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility, or for verifying operational phase noise levels.
8.	Occupational Health and Safety
i.	Non-ionizing radiation

S.N	Relevant Requirements as Stated in EHS Guidelines
a.	Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;
b.	Training of workers in the identification of occupational EMF levels and hazards;
c.	Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure.
d.	Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.
ii.	Heat
a.	Regular inspection and maintenance of pressure vessels and piping;
b.	Provision of adequate ventilation in work areas to reduce heat and humidity;
c.	Reducing the time required for work in elevated temperature environments and ensuring access to drinking water;
d.	Provisions of shielding surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc;
e.	Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes.
iii.	Confined Spaces
a.	Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
b.	Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible.
c.	Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing.
d.	Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.
e.	Appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified.
iv.	Electrical Hazards
a.	Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization;
b.	Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components
c.	Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them;
d.	Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits.
v.	Fire and Explosion Hazards
a.	Use of automated combustion and safety controls;
b.	Proper maintenance of boiler safety controls;
c.	Use of automated systems such as temperature gauges or carbon monoxide sensors to survey solid fuel storage areas to detect fires caused by self-ignition and to identify risk points.
d.	Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible.
e.	Provision of manual fire fighting equipment that is easily accessible and simple to use. Fire and emergency alarm systems that are both audible and visible.
f.	Defining and labelling fire hazards areas to warn of special rules.
g.	Providing specific worker training in handling of flammable materials, and in fire prevention or suppression
h.	Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection systems.
vi.	Chemical Hazards

S.N	Relevant Requirements as Stated in EHS Guidelines
a.	Consider generation of ammonia on site from urea or use of aqueous ammonia in place of pure liquefied ammonia;
b.	Consider use of sodium hypochlorite in place of gaseous chlorine.
c.	Implementation of engineering and administrative control measures to avoid or minimize the release of hazardous substances into the work environment keeping the level of exposure below internationally established or recognized limits.
d.	Communicating chemical hazards to workers through labelling and marking according to national and internationally recognized requirements and standards.
e.	Training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of PPE
vii.	Dust Management
a.	Use of dust controls (e.g., exhaust ventilation) to keep dust below applicable guidelines or wherever free silica levels in airborne dust exceed 1 percent;
b.	Regular inspection and maintenance of asbestos containing materials.
viii.	Community Health and Safety
a.	Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public
b.	Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection
c.	Modifying process or storage conditions to reduce the potential consequences of an accidental off-site release
d.	Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration
ix.	Traffic Safety
a.	Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

2.6 International and National Environmental Standards/ Guidelines

Bangladesh and World Bank environmental standards and guidelines relevant to the construction and operation of the Gas Fired Modular Combined Cycle Power Plant that cover the following issues[5]:

- Atmospheric emissions and ambient air quality;
- Water Quality; and
- Liquid effluent discharges to the water environment.
- Noise emissions and ambient noise levels.

2.6.1 Atmospheric Air quality

As per the provisions of Rules 12 and 13 of the ECR 1997, the MoEF is responsible for laying down environmental quality standards (pertaining to air, water, sound, odour and other components) and standards for discharge and emission of waste. Ambient air quality standards have been stipulated in Schedule 2 (Standards for Air) of the Rules. Recently, these standards were revised by MoEF in 2005 as provided in the Table 2-7.

[5] *When host country regulations differ from the levels and measures presented in the EHS Guidelines, project is expected to achieve whichever is more stringent.*

Table 2-7: National Air quality Standards of Bangladesh (2005)

Pollutant	Averaging Time	Concentration
Carbon Monoxide (CO), mg/m^3	8 hours	10 (9 ppm)
	1 hour	40 (35 ppm)
Lead (Pb), µg/m^3	Annual	0.5
Oxides of Nitrogen (NO_x), µg/m^3	Annual	100 (0.053 ppm)
Sulphur dioxide (SO_2), µg/m^3	Annual	80 (0.03 ppm)
	24 hours	365 (0.14 ppm)
Suspended Particulate Matter (SPM), µg/m^3	8 hours	200
Coarse Particulates (PM_{10}), µg/m^3	Annual	50
	24 hours	150
Fine Particulates ($PM_{2.5}$), µg/m^3	Annual	15
	24 hours	65
Ozone (O_3), µg/m^3	8 hours	157 (0.08 ppm)
	1 hour	235 (0.12 ppm)

Source: Air Quality Standards, 2005[6]

The emission standards pertaining to the power plant are also provided as *'Standards for Gaseous Emission from Industries or Projects', Schedule 11* of the ECR, 1997 Table 2-8.

Table 2-8: Standards for Gaseous Emission from Industries or Projects in Bangladesh

S. No	Parameter	Standard
1.	Particulate for a power plant with capacity of 200 MW or above	150 mg/Nm^3
Oxides of Nitrogen for Gas Fuel based Power Plant		
2.	500 Megawatt or above	50ppm
3.	200 to 500 Megawatt	40ppm
4.	Below 200 Megawatt	30ppm

Source: Schedule 11 of the ECR, 1997

WBG also has provided general ambient air quality guidelines as well as emission guidelines for Thermal Power Plants and these are provided in Table 2-9 and Table 2-10.

Table 2-9: WBG prescribed Ambient Air Quality Guidelines

Parameter	Averaging Period	Guideline value in µg/m^3
Sulphur Dioxide (SO_2)	24 hour	125 (Interim Target – 1) 50 (Interim Target – 2) 20* (Guideline)
	10 minute	500
Nitrogen dioxide (NO_2)	1-year	40
	1-hour	200
Particulate Matter PM_{10}	1 Year	70 (Interim Target – 1) 50 (Interim Target – 2) 30 (Interim Target – 3)

[6] http://www.case-moef.gov.bd/file_zone/reports_publications/BGD%20AQ%20and%20VES%20standard_BW.pdf

Parameter	Averaging Period	Guideline value in µg/m^3
		20 (Guideline)
	24 hour	150 (Interim Target – 1) 100 (Interim Target – 2) 75 (Interim Target – 3) 50 (Guideline)
Particulate Matter $PM_{2.5}$	1 Year	35 (Interim Target – 1) 25 (Interim Target – 2) 15 (Interim Target – 3) 10 (Guideline)
	24 hour	75 (Interim Target – 1) 50 (Interim Target – 2) 37.5 (Interim Target – 3) 25 (Guideline)
Ozone	8-hour daily maximum	160 (Interim Target -1) 100 (Guideline)

** Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines*

Table 2-10: Emissions Guidelines (in mg/Nm3 or as indicated)

S. No.	Combustion Technology/Fuel	Particulate Matter (PM)		Sulphur Dioxide (SO2)		Nitrogen Oxides (NOx)	
	Boiler	NDA	DA	NDA	DA	NDA	DA
1.	Natural Gas	N/A	N/A	N/A	N/A	240	240
2.	Other Gaseous fuels	50	30	400	400	240	240

General notes:

MWth = Megawatt thermal input on HHV basis; N/A = not applicable; NDA = Non-degraded air shed; DA = Degraded air shed (poor air quality); Air shed should be considered as being degraded if nationally legislated air quality standards are exceeded. MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack. Guideline limits apply to facilities operating more than 500 hours per year.

- Targeting the lower guidelines values and recognizing issues related to quality of available fuel, cost effectiveness of controls on smaller units, and the potential for higher energy conversion efficiencies (FGD may consume between 0.5% and 1.6% of electricity generated by the plant).
- Targeting the lower guidelines values and recognizing variability in approaches to the management of SO2 emissions (fuel quality vs. use of secondary controls) and the potential for higher energy conversion efficiencies (FGD may consume between 0.5% and 1.6% of electricity generated by the plant). Larger plants are expected to have additional emission control measures. Selection of the emission level in the range is to be determined by EA considering the project's sustainability, development impact, and cost-benefit of the pollution control performance.
- Stoker boilers may require different emissions values which should be evaluated on a case-by-case basis through the EA process.

Source: WBG EHS Guidelines on Thermal Power Plants

2.6.2 Water quality standards

As per Schedule 12 of the ECR 1997, designated best use classification has been prescribed for inland surface water as given in Table 2-11.

Table 2-11: Standards for inland surface water

S. No.	Best Practice based classification	Parameter			
		pH	BOD, mg/l	DO, mg/l	Total Coliform number/100
a.	Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b.	Water usable for recreational activity	6.5 – 8.5	3 or less	5 of more	200 or less
c.	Source of drinking water for supply after conventional treatment	6.5 – 8.5	6 of less	6 or more	5000 or less
d.	Water usable by fisheries	6.5 – 8.5	6 of less	5 or more	---
e.	Water usable by various process and cooling industries	6.5 – 8.5	10 or less	5 or more	5000 or less
f.	Water usable for irrigation	6.5 – 8.5	10 or less	5 or more	1000 or less

Notes:
1. In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2.Electrical conductivity for irrigation water – 2250 µ mhoms/cm (at a temperature of 25 ° C); Sodium less than 26%; boron less than 0.2%.

2.6.3 Liquid Effluent Discharges

As per Schedule 10 of ECR 1997, standards for Waste from Industrial Units or Project Waste have been described. The same has been detailed in table below:

Table 2-12: Standards for inland surface water

S. No.	Parameter	Unit	Places for determination of standards		
			Inland Surface Water	Public Sewerage System connected to treatment at second stage	Irrigated Land
1	Ammonical Nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as)	mg/l	0.2	0.05	0.2
4	BOD 5 at 20^{o}C	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as CD)	mg/l	0.5	0.05	0.05
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved Oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	micro mho/ cm	1200	1200	1200
14	Total Dissolved Solids	mg/l	2100	2100	2100
15	Fluoride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iran (as Fe)	mg/l	2	2	2
18	Total Kjeldahl Nitrogen (as N)	mg/l	100	100	100

S. No.	Parameter	Unit	Places for determination of standards		
			Inland Surface Water	Public Sewerage System connected to treatment at second stage	Irrigated Land
19	Lead (as Pb)	mg/l	0.1	1.0	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10	Not yet Fixed	10
24	Oil and Grease	mg/l	10	20	10
25	Phenolic Compounds (as C_6H_5OH)	mg/l	1.0	5	1
26	Dissolved Phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission			
28	pH	-	6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total Dissolved Solids	mg/l	2100	2100	2100
	Temperature	° C	40	40	40-Summer
32			45	45	45-Winter
33	Suspended Solids (SS)	mg/l	150	500	200
34	Cyanide (as Cn)	mg/l	01	2.0	0.2

Notes:
(1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector-wise industrial effluent or emission."
(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.
(3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.
(4) Inland Surface Water means drains/ponds/tanks/water bodies/ditches, canals, rivers, springs and estuaries.
(5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.
(6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.
(7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

As per the WBG EHS guidelines, the treated sanitary sewage discharge is required to meet the following guidelines (Table 2-13).

Table 2-13: Treated Sewage Discharge Guidelines of WBG

S. No.	Parameter	Guideline Value
1.	pH	6-9
2.	BOD	30mg/l,
3.	COD	125mg/l,
4.	Total Nitrogen	125 mg/l,
5.	Oil and Grease	10 mg/l,
6.	Total Suspended Solids	50 mg/l and
7.	Total coliform bacteria	400 MPN/100 ml

2.6.4 Noise Emissions and Ambient Noise Levels

As per WBG EHS Guidelines, noise impacts should not exceed the levels presented in Table 2-14, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 2-14: Noise Level Guidelines

Receptor	One Hour L_{eq} (dBA)	
	Daytime, 07:00 - 22:00	Night time, 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Noise Pollution (Control) Rules, 2006 were laid down by the Ministry is furnished in the Table 2-15.

Table 2-15: Ambient noise standards

S.No.	Type of Area	Limits in dB(A) L_{eq}	
		Day	Night
1.	Silent Zone	50	40
2.	Residential area	55	45
3.	Mixed area	60	50
4.	Commercial area	70	60
5.	Industrial area	75	70

Note:
dB(A) Leq represents time-weighted average noise level on the Decibel-A scale
Day time is from 6am to 9pm, Night time is form 9pm to 6 am
Mixed area is mainly residential area, and also simultaneously used for commercial and industrial purposes
Area up to a radius of 100 m around hospitals/educational institutions/special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

2.7 Applicable International Conventions

Environmental problems, which migrate beyond the jurisdiction (Trans-boundary), require power to control such issues through international co-operation by either becoming a Contracting Party (CP) i.e., ratifying treaties or as a Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. Bangladesh has ratified various Multilateral Environmental Agreements (MEAs), International Labour Organisation (ILO) Conventions, and international maritime conventions. The relevant international conventions have been summarized in the Table 2-16.

Table 2-16: Applicable International Conventions

S. No	International Conventions	Salient Features
Multilateral Environmental Agreements (MEA)		
1.	Rio Declaration, 1992	Bangladesh is a signatory to Principle 4 of the declaration 1992 a global action program for sustainable development called *Rio Declaration* and *Agenda 21* was adopted in the annual United Nations Conference on Environment and Development (UNCED) held in Rio De Janeiro, Brazil.
2.	Convention on Biological Diversity, 1992	It was adopted on June 5, 1992. The signatory has an obligation of: • Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and • Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account.

S. No	International Conventions	Salient Features
		As per the convention, ESIA shall consider impacts on biodiversity due to project activities.
3.	Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971)	This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance', the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves. Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) are one of the Ramsar Sites.
4.	United Nations Convention on the Law of the Sea, Montego Bay, (1982)	Main objectives of the convention are: • To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and • To establish basic environmental protection principals and rules on global and regional co-operation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to all sources of marine pollution.
International Labour Organisation (ILO) Conventions		
1.	International Labour Organisation Conventions	Bangladesh has ratified many of the International Labour Organization conventions that are relevant to the Project including: • C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified); • C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified): • C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified): • C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified); • C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified); • C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified); • C107 Indigenous and Tribal Populations Convention, 1957 • C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified)This Convention limits the hours of work in industrial undertaking to eight (8) in the day and forty-eight (48) in the week
Multilateral Environmental Agreements (MEA)		
1.	Kyoto Protocol	The protocol is aimed at reducing greenhouse gas (GHG) emissions from various industrial activities and curbing its effects on the environment. Seven GHGs have been identified for targeted emission reduction namely: • Carbon dioxide (CO_2) • Methane (CH_4) • Sulphur hexafluoride (SF_6) • Nitrous Oxide (N_2O) • Nitrogen trifluoride (NF_3) • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFC) The parties to the protocol shall reduce their GHG emissions through one or more of the three flexible mechanisms laid down under the

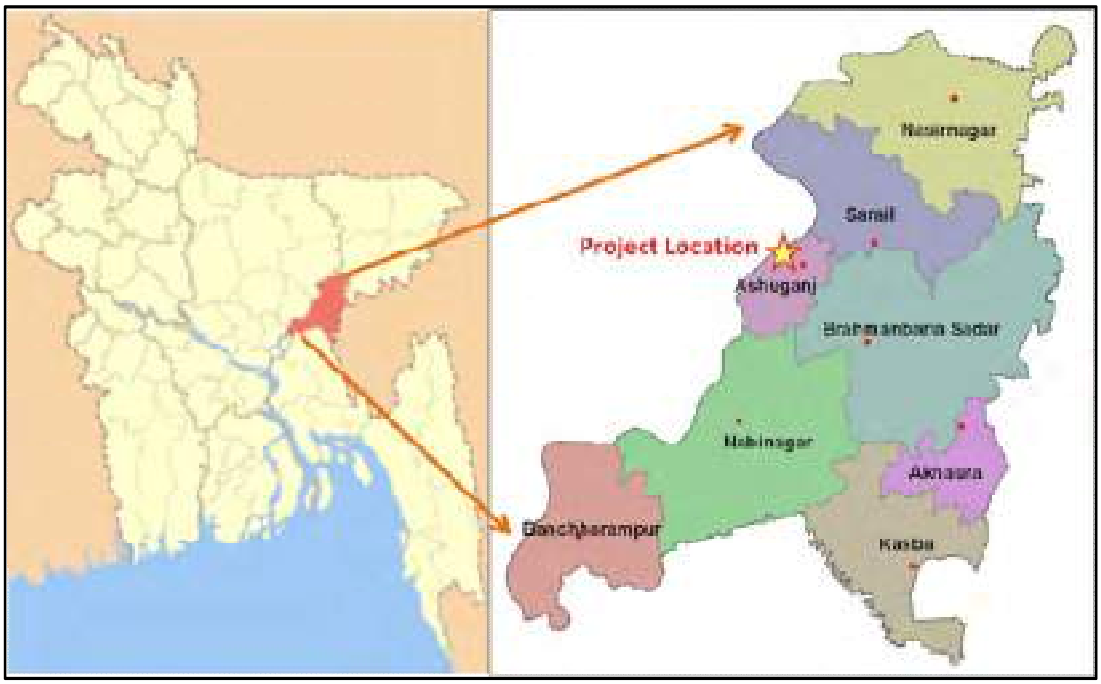
S. No	International Conventions	Salient Features
		protocol viz. : 1. Clean Development Mechanism 2. Joint Implementation 3. International Emissions Trading The protocol formulated in 1997 and came into force in 2008. It's currently under its second commitment period which terminates in 2020. Bangladesh signed the protocol October 22, 2001. However, it has no binding emission reduction target as it's a developing nation.
2.	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	It was formulated to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate. The wastes under the Convention's scope are listed under its Annex – I, II and III. In addition to conditions on the import and export of wastes, there are stringent requirements for notice, consent and tracking for movement of wastes across national boundaries. The Convention came into force on May 5, 1992. Bangladesh accepted it on April 1, 1993.

3. PROJECT DESCRIPTION

3.1 Project Location

The 200 MW UAEL power plant is located in Sonarampur Village of Ashuganj Upzila in Brahmanbaria District (Figure 3-1). Ashuganj is located on the east bank of the Meghna River at about 85 km Northeast of the city of Dhaka. The site can be reached by Dhaka-Sylhet Highway, through Wapda road which connects to the Ashuganj Power Station Complex to the highway. Adjacent to the village of Sonarampur, are the villages of Char Chartola, Ashuganj and Shohagpur. However, due to the industrial growth in the region leading to rapid commercial growth, the area is locally referred to as 'The Ashuganj Hub' or 'Ashuganj Power Complex'. Ashuganj has a railway station, which is located at about 1 km away from the site. Ashuganj has a cargo jetty as well as passenger terminal (launch ghat) and is well connected to ports of Mongla and Chittagong.

Figure 3-1: Location of the Proposed Project



3.2 Description of the Site

"Ashuganj" due to its proximity to the Titas Gas field and its location at the bank of river Meghna was selected as the suitable space for establishing the largest power plant of the country in 1966. A total of 16.43 acres (66490 m^2) of land on the north-east side of the Meghna Railway Bridge was found suitable for the construction of the power plant complex.

The chosen land belonged to Bangladesh Railways and was transferred to APSCL on 99 years lease for the purposes of setting up of power plants. At present the all the operational power plants are located within the 16.43 acres of land and power generation capacity of the existing 7 units of APSCL is 671 MW.

APSCL in recent past has also allowed few private power plants in the area. To encourage contribution of private companies in capacity augmentation, APSCL put forth a tender for a 200 MW

power plant on Build, Own and Operate Basis in 2012, which was successfully contended by United Enterprises & Co. Ltd (UECL).

The project was awarded to UECL on 12th January 2013. Subsequently, on 30th January 2013, UAEL was formed and wherein, UECL has a share of 71% and APSCL holds the remaining 29% of the share. The APSCL as per the agreement provided and area of 6.48 acres (out of 16.43 acres) to UAEL on lease (Figure 3-2). The 200 MW of UAEL is constructed over an area of 3.5 acres, while the remaining area is used as warehouse, which proponent plans to be used for future expansion.The chronological order of events of land lease, land transfer, obtaining clearances for setting up of the UAEL plant are provided in Table 3-1.

Table 3-1: Chonological order of events

Activity	Date
Land Lease Agreement between Bangladesh Railway and Ashuganj Power Station Co. Ltd	19 September 2013
Power Purchase Agreement with Bangladesh Power Development Board	27 October 2013
Implementation Agreement with Government of Bangladesh	27 October 2013
Land Lease Agreement between UAEL and Ashuganj Power Station Co. Ltd	27 October 2013
Share Purchase Agreement with Ashuganj Power Station Co. Ltd.	27 October 2013
Gas Supply Agreement with Bakhrabad Gas Distribution Co. Ltd	19 February 2014

The site is located at about 350 – 400 m from the east bank of the River Meghna (Figure 3-2). In the north direction of the project, there are five government owned food storage godowns. There is a redundant old railway line in front of these food godowns and adjacent to the boundary of the project site there are unauthorised saw mills and slum habitation. Several water ponds are located on the backside of the plant, i.e., North (N) to North West (NW). These ponds are as close as 40- 50 m from the plant. Ashuganj Bazar and residential areas are situated at about 250 m towards the N of the plant.

All existing power plants of APSCL, i.e., Unit 1 to 5, GT 1 & 2, ST, along with existing 230 and 132 KV Sub stations are located on the North East of the UAEL plant. The colony of APSCL is located very close on the South East direction of the site. The APSCL colony has small market, worship areas, school, playground, medical centre, auditorium, training centre, club and residential flats.

Two 450 MW Combined Cycle Plants, i.e., 2x 450 MW CCPP (North and South) are under construction towards the South of UAEL plant. A 400/ 230 KVA Sub-station is also planned to be developed near these 450 MW plants.

It is important to note that the area has about 400 – 500 rice mills (locally called as 'Chatal') towards the Eastern side, as close as 350 m from the UAEL plant (Figure 3-3). These mills operate all through the year and cycle of operation starts as soon as new rice crop is received in April each year. About 100 – 150 migrant workers are employed in each of these mills, who are provided with basic accommodation within the mill compounds, for the period of their employment.

Figure 3-2: Close up of the Project Sites

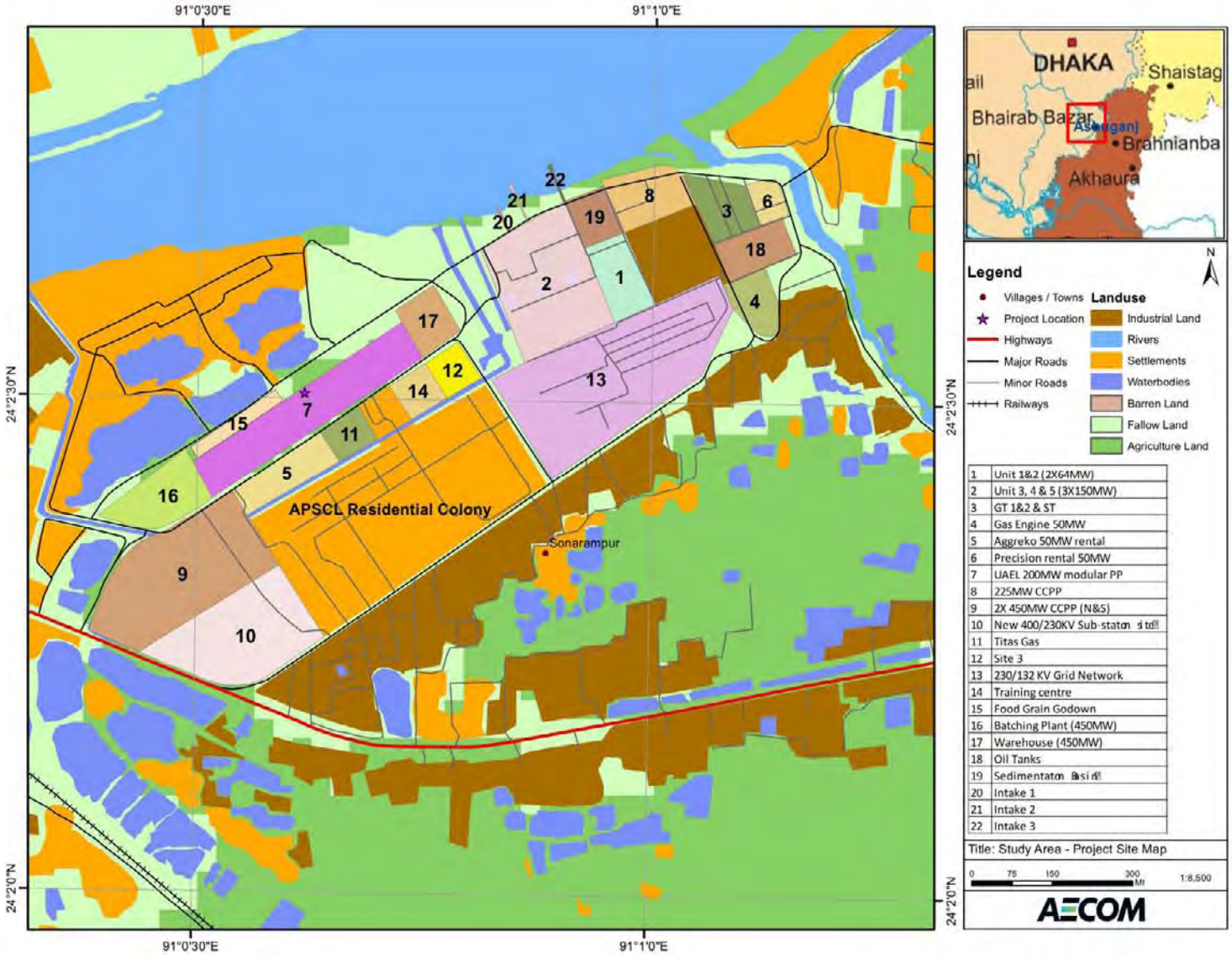


Figure 3-3: Location of Rice Mills and the Proposed Plant (Photo: close up of Rice Mill)

3.3 Project Details

The project is a 200 MW Combined Cycle Modular Power Plant (CCMPP). The plant is conceived with 20 Wartsila (34SG) gas engines generators of 9.73 MW each and one steam turbine of 16.1 MW (Triveni make). The Engineering, Procurement and Construction (EPC) of the plant was awarded to Neptune Commercial Ltd. (NCL), which is a sister concern of the United Group. The project was executed on a turnkey basis and the construction of the project commenced in February, 2014. In April, 2015 the construction was completed and thereafter the project was handed over to UAEL management for commissioning and production. The layout and flow diagram of the plant are shown as Figure 3-4 and Figure 3-5.

The project receives gas about 40 Million Metric Standard Cubic Feet per Day (MMSCFD) from the Bhakrabad Gas Distribution Company Limited (BGDCL), which is monitored through a Regulation and Monitoring Station (RMS). The gas is supplied to the 20 Wartsila engine units for power generation, which is sent through alternators (20 units) to the substation through 11KV lines. The exhaust gas is sent to the waste heat recovery boilers of 4.12 TPH capacity each (20 units). The steam generated is used in the steam turbine generator (16.1 MW) to generate power, which is passed through alternators to the substation. The power generated is stepped up to 230KV at the substation and sent to APSCL substation through Overhead/Underground cable.

The subsequent sections describe various components of the proposed project in details.

3.3.1 Gas Regulation and Monitoring Station

The UAEL plant utilises Natural Gas as fuel, which is supplied to the plant by BGDCL, through its District Regulating Station (DRS) at Ashuganj. A valid Gas Supply Agreement was signed between BGDCL and UAEL on 19th February, 2014.

A dedicated 1 km long pipeline of diameter 10 inches is constructed to transport gas at 1000 psi to RMS of capacity 40 MMSCFD at the site. Gas is be supplied to the engines through a 3 inch diameter pipeline at 70 psi from the RMS facility. The composition of the Gas supplied to the plant is mainly Methane and absence of Sulphur content is reported (Table 3-2).

Table 3-2: BGDCL Gas Analysis

Gas Composition		
	% Mole	%Wt
Nitrogen	0.429	0.713
CO_2	0.104	0.271
Methane	96.375	91.711
Ethane	2.074	3.698
Propane	0.459	1.201
i-Butane	0.15	0.518
n-Butane	0.103	0.354
i-Pentane	0.058	0.248
n-Pentane	0.04	0.17
Hexanes	0.108	0.528
Heptanes	0.104	0.593
Total	100	100
Temperature	80°F	
Pressure	530 psig	
Specific Gravity	0.5820 at ISO condition 15°C& 01.325kPa	
Ideal Density	0.7132 kgm^3	
Real Gas Density	0.715kgm^3	
Mole Weight	16.8589gm/mol	
Compressibility	0.9975	
Higher Heating Value	38.9497 MJ/ sm^3	
Higher Heating Value	1045.4333 BTU/SCF	
Lower Heating Value	35.1185 MJ/$8m^3$	
Lower Heating Value	942.6013 BTU/SCF	

3.3.2 Reciprocating Engines

The plant has installed twenty reciprocating gas engines of Wärtsilä make (W20V34SG) having power generation capacity of 9.73 MW each. Specifications of the Wärtsilä engines are attached as Annexure VI.

A reciprocating engine is a heat engine, also known as a piston engine that uses reciprocating pistons to convert pressure into a rotating motion. The proposed facility is based on spark ignition four-stroke engine (Figure 3-6), in which the piston completes four separate strokes to complete a single thermodynamic cycle.

Intake/Admission Stroke: During this stroke the piston moves downward due to the pressure exerted by the combustible fuel and air admitted into the cylinder through the opening of intake valve.

Compression Stroke: During the compression stroke, the crankshaft continues to rotate, the piston is forced upward in the cylinder, and both intake and exhaust valves are closed. The movement of the piston upward compresses the fuel-air mixture. As the piston approaches the top of its stroke within the cylinder, an electric spark is introduced to ignite the compressed fuel-air mixture.

Figure 3-4: Layout of the Plant

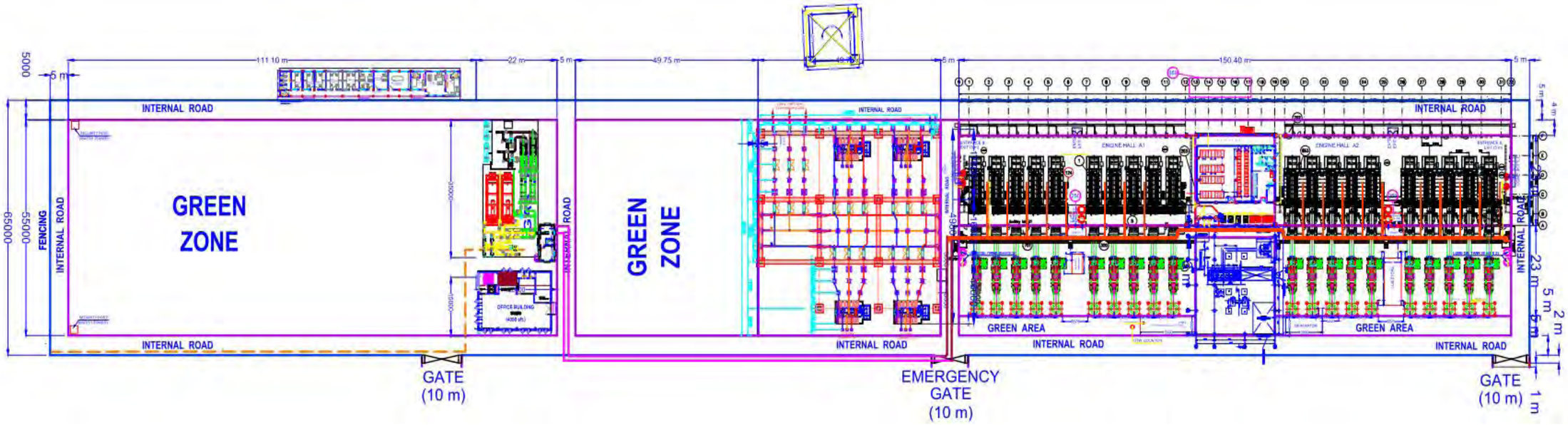
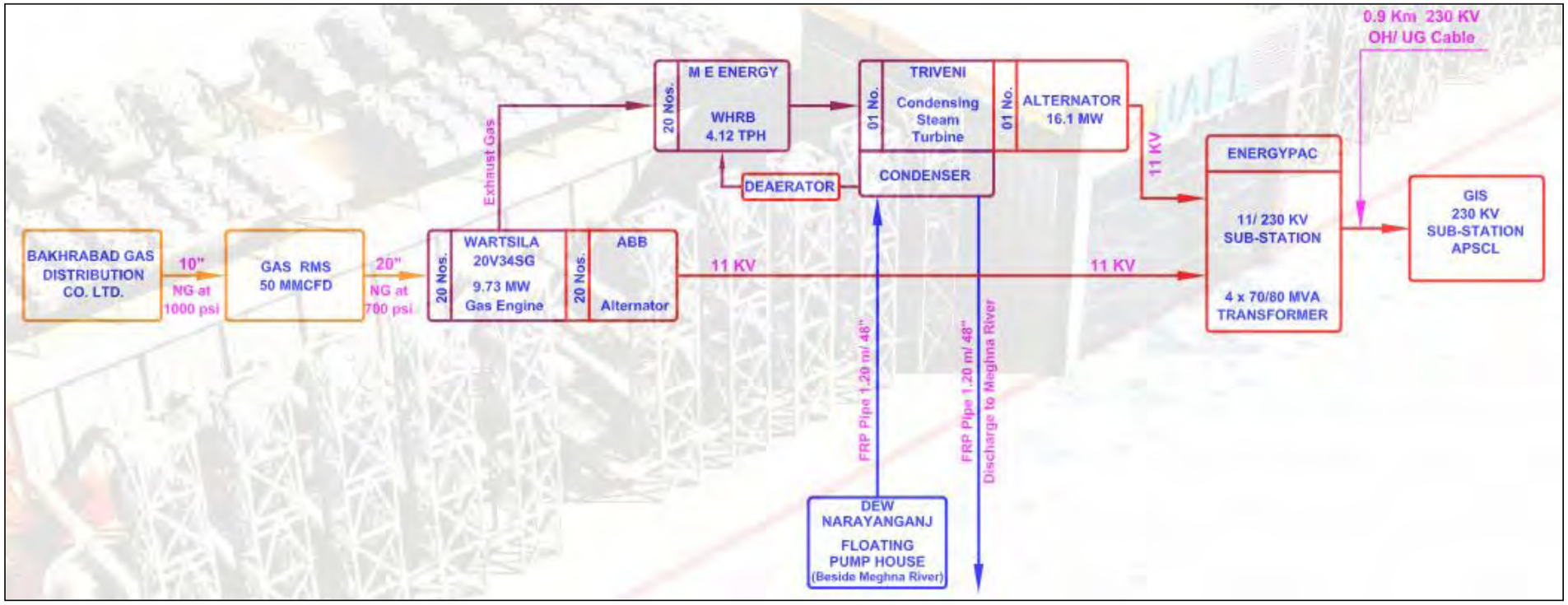
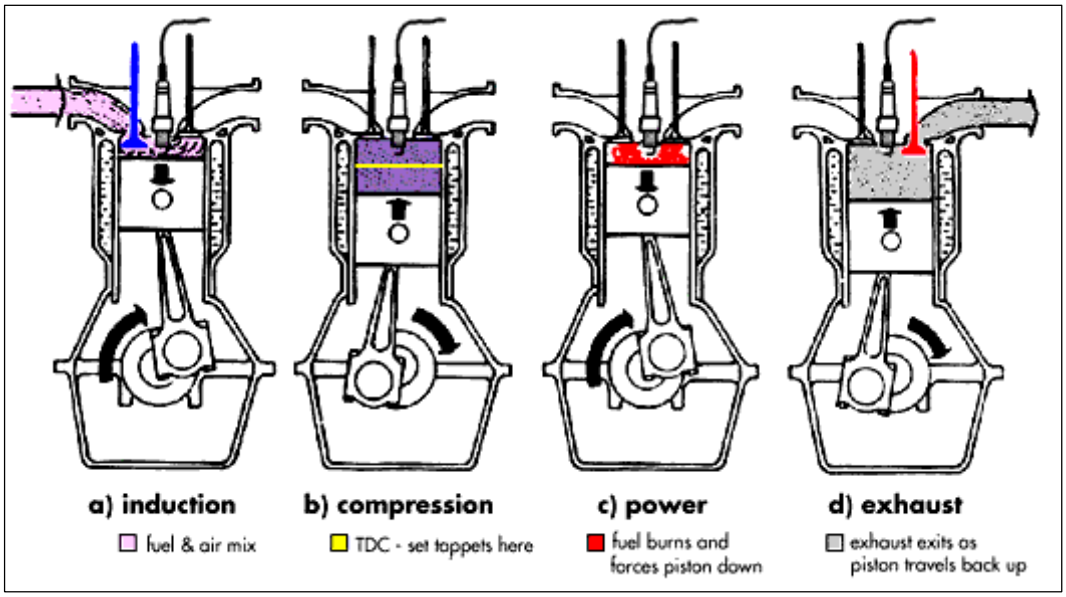


Figure 3-5: Flow Diagram for the Proposed Plant



Power/Expansion Stroke: After ignition, the fuel-air mixture burns and hot gases obtained by combustion exert tremendous pressure on the piston to force it to move downward. This causes the crankshaft to revolve and power is produced.

Figure 3-6: Four Stroke Event Cycle



Exhaust/Scavenging Stroke: By the end of power stroke the pressure within chamber is greatly reduced because of the expansion of the gases. At this stage, the exhaust valve opens as the crankshaft continues to revolve and the piston is again moved upward in the cylinder by the connecting rod. The hot gases in the cylinder are forced out through the exhaust valve.

It is important to mention that the Wärtsilä 34SG engine works on the lean-burn concept. The air-fuel ratio is very high and is uniform throughout the cylinder, which reduces the peak temperature and also NOx production during combustion. To ensure correct air-fuel ratio and the correct timing of the ignition, every cylinder is individually controlled.

3.3.3 ABB Alternator

An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current. Each of the gas engines is coupled with ABB alternators, providing a modular configuration to the plant and allows a greater flexibility in operation as well as maintaining uniform efficiency at variable load. Synchronous alternators engaged will generate electricity at 11 kV.

3.3.4 Waste Heat Recovery Boiler

The hot exhaust gases from the engines are supplied to the Waste Heat Recovery Boilers (WHRB) to produce steam at a rate of 4.12 tonnes per hour at 22 bars and 360 °C (Table 3-3).The Boiler at the proposed plant is a single drum natural circulation type boiler where water is in tube side and flue gases on the shell side. There are 20 such WHRB working in the plant.

Table 3-3: Specification of Boiler

Features	Values
Exhaust Gas flow from Engine	55162 Kg/hr
Exhaust Gas Temperature	380 ^{0}C
HP Steam Pressure @ Boiler outlet	20 bar (a)
HP Steam Temperature @ Boiler outlet	360 ^{0}C
Superheated Steam Flow	4120 Kg/hr
Gas Outlet Temperature	176^{0}C
Draught Loss over Boiler	250 mm WC
Boiler Feed Water Temperature	105 ^{0}C
Blow down	2.5 %

3.3.5 Steam Turbine

The steam from all the 20 boiler units is fed to the steam turbine coupled with alternator to generate 16.1 MW of power at 11 kV (Table 3-4).

Table 3-4: Specification of Steam Turbine Generator

S. No.	Description	Units	Parameter
1	Number of Turbine		1
3	HP Steam pressure at the turbine isolation valve	bar (a)	18
4	HP Steam temperature at the turbine	^{0}C	355
5	HP Steam flow at turbine inlet.	TPH	81.5
6	Power Generated at the alternator terminals at 11kv and 0.8 Cos	kW	16200
7	Turbine capacity	kW	16100
8	Turbine speed	rpm	6225
9	Turbine exhaust pressure	bar (a)	0.1
10	Cooling water temperature (Maximum)	^{0}C	32
	Alternator		
11	Number of AC generator		1
12	Alternator capacity	KW	18000
13	Power factor of alternator		0.8 (Lag)
14	Speed of alternator	rpm	1500 rpm /4 Pole
15	Rated voltage of alternator	kV	11(+/-)10%
16	Frequency	Hz	50 (+/-) 5%
17	Noise level	dB(A)	90
18	Insulation		Class F
19	Temperature rise/tolerance		Class B
20	Excitation		Brushless
21	Cooling		Water cooled (CACW)
22	Noise level	DB (A)	90 at 1 m

3.3.6 Condenser

The exhaust steam is taken to the condenser unit which has an open cycle cooling arrangement, i.e., once through. Anticipated increase in temperature across condenser is about 9.5^{0}C.

3.3.7 Power Evacuation

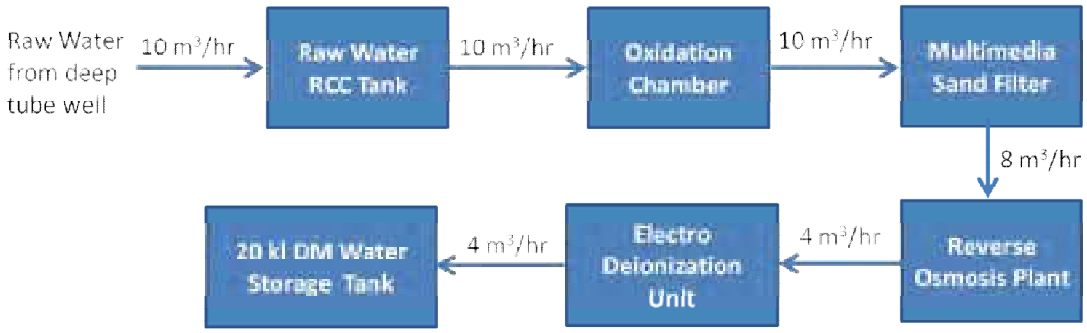
The power generated at the alternators is evacuated through four On Load Tap Changer (OLTC) power transformers (70/80 MVA, 11/230 kV). Further, Four units of 1250 A, 40 kA, 230 kV, SF 6

breakers have been installed at the HT side. The auxiliary transformers have 630A/1250A, 50kA, 11 kV SF 6 breakers. The UAEL sub-station supplies this power to 230 kV GIS substation of APSCL located within the APSCL complex via four steel lattice towers each having height of 40 m.

3.3.8 DM Plant

A Demineralised (DM) water treatment plant with 4 m^3/hr capacity is established to treat groundwater to be used in the boilers. Ground water is extracted through a deep tube well at 10 m^3/hr, which is stored at an underground RCC tank. It is then taken for pre treatment and demineralisation (Figure 3-7). Approximately 4m^3/hr of treated water is produced through the process, which is stored at 20 kl DM tank. Out of the total 2.4 m^3/hr of DM water will be utilised as make - up water to produce steam in the boilers. The rest will be utilised for consumption at the plant.

Figure 3-7: Configuration of DM Water Plant



3.3.9 Greenbelt

As mandated in the environmental clearance conditions (Annexure III and IV), the plant is required to maintain 33% of its total area under Green Zone. Considering this, greenbelt has been proposed to be developed at the site and plan for the same has been prepared (Figure 3-8). At present there is no green zone at the site.

3.3.10 Strom Water Drains

Drains are provided all around the project site to collect the storm water. On the West, this drain is about 500 mm wide and 250 mm deep and near the discharge point on the East, the depth of the drain increases to 900 mm (Figure 3-9). A slope of 1:500 is provided from West to East. The storm water is discharged to the open channel running across Ashuganj. It is important to mention that separate underground drains are provided around the engine halls so as to avoid contamination of storm water and facilitate collection of all the oily water in an underground tank for treatment.

3.3.11 Administrative Building

Administrative building is five storeys, where most of the staff is accommodated. A canteen is also provided on the third floor of this building. The Building also has provision of storage of lube oils and other chemicals.

Figure 3-8: Green Zone

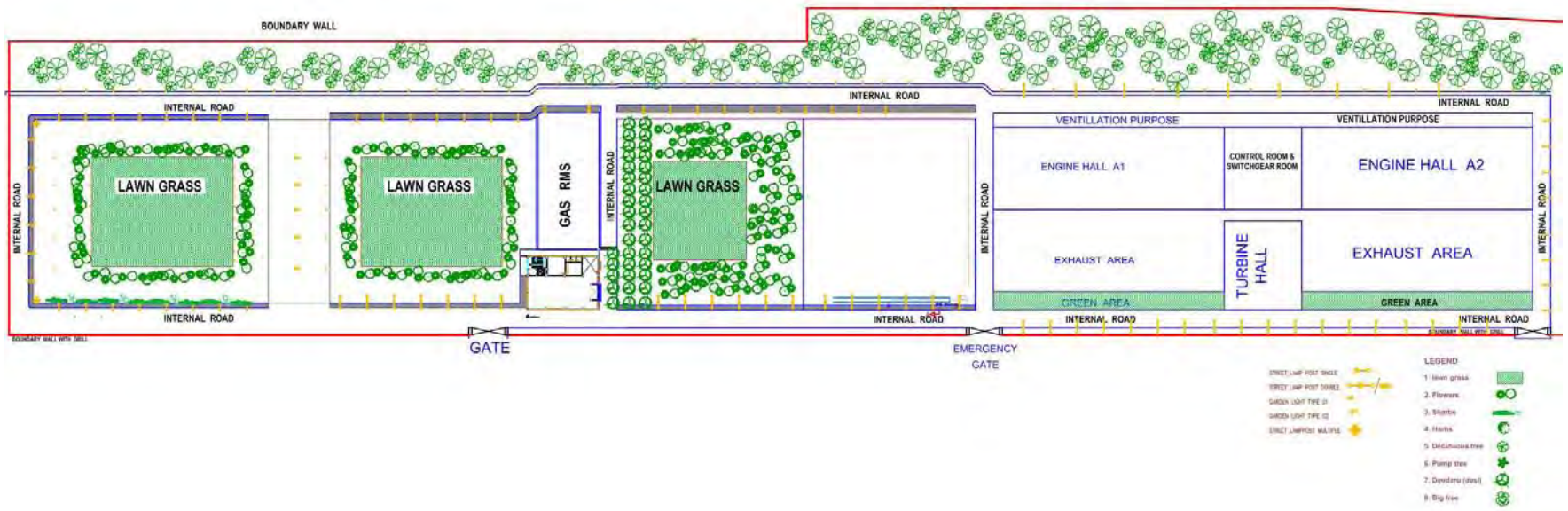
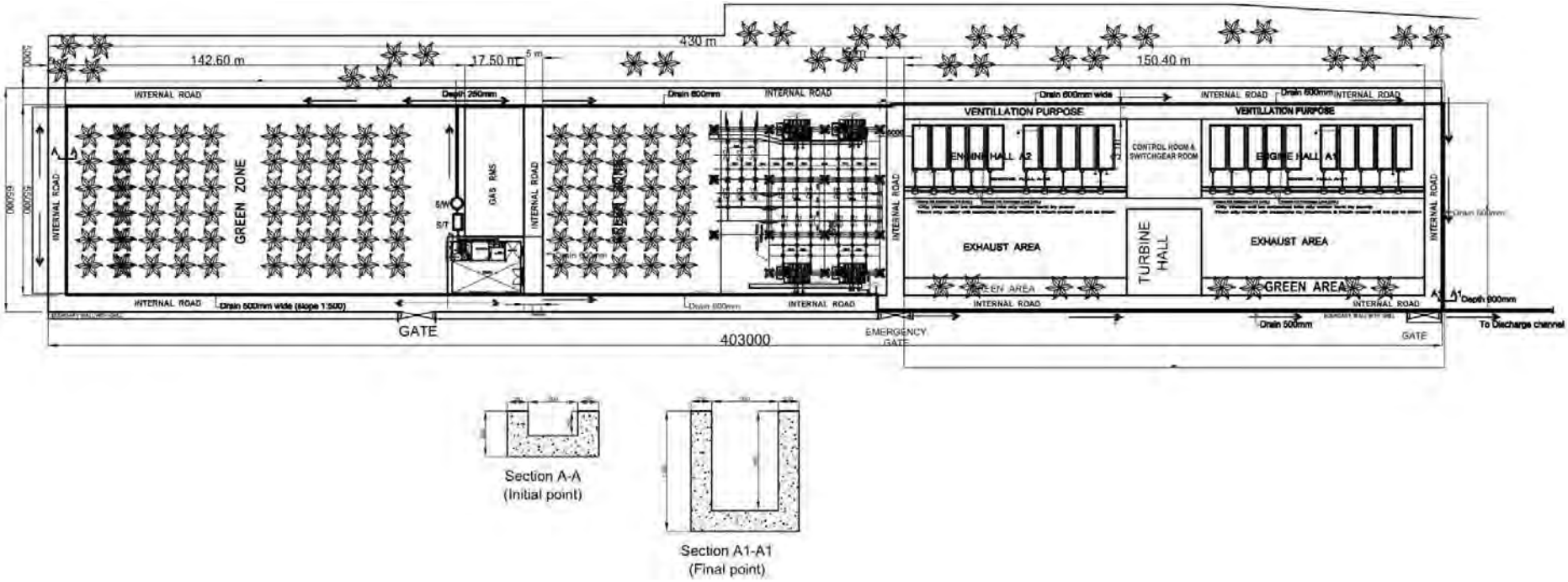


Figure 3-9: Storm Water Drain Alignment



3.4 Resource Required and Utilities

3.4.1 Project Land

The entire area of the 'Ashuganj Industrial Hub' is owned by the Bangladesh Government and is the property of the Bangladesh Railways Authority. The APSCL has procured the land from the Railways Authority for a period of 99 years, via agreement dated 19 September 2013 (Annexure VII). Subsequently, upon awarding the 200 MW project to the UAEL, 6.48 acres of land has been leased to UAEL by APSCL from its total parcel of 16.43 acres along with all rights of way (Annexure VIII).

A No Objection Certificate (NOC) dated 12th November 2013 for the project has been obtained from Ashuganj Union Parishad. As per the NOC, the total land of 6.48 acres falling under Katina No. 178, Drag No. 664 (Part) & 220 (Part) and within the Sonarampur Mouse have been provided for the project. According to this document, the land has been classified as non agricultural.

It was reported that the land area was mostly barren and comprised a ditch. Fishing activities used to be carried out in the ditch while small patches of land were used for minor agricultural activities by twelve (12) people/families who had agriculture/ fishery licenses. Out of the twelve licensees only three (3) licenses were still valid (yet to expire) on the date of allotment of the land from the Railway authorities to APSCL. The Bangladesh Railway Authority mentioned the compensation amount to be paid to these fishermen by APSCL in the lease agreement signed on 19th September 2013. It was reported that APSCL paid adequate compensation to the fishermen before transferring land to the UAEL.

The land had been lying barren and unused prior to its procurement by UAEL for the project. Since it was fenced by APSCL, the land was neither used for grazing of livestock by the surrounding community, nor for any commercial activity. Hence, there has been no physical or economic displacement resulting out of the land procurement process by UAEL.

3.4.2 Manpower

During the construction phase of the project, NCL was hired as EPC contractor. A total of about 100 people of NCL were employed during this time. It was also reported that two local contractors were hired during construction, i.e., SBS Construction & Meghna Consortium for the provision of construction material and also manpower. A total of 410 workers were employed from SBS Construction (about 250 workers) and Meghna Consortium (about 160 workers).

All the construction work is over at the site and the plant is fully operational. The operation and management of the plant is handed over to UAEL. During operations, a total of 140 persons will be required at the plant (Table 3-5). The work hours are divided into three shifts of 8 hours and about 40 – 45 persons work during each shift.

Out of the total 140 persons, UAEL has engaged permanent employees comprising of a total of 25 individuals (including four women) from the local communities around the project site. As reported by the Site Management, the criteria of employing these professionals were because of their

expertise and requisite qualifications necessary to fill the post as compared to the fact that they belonged to the local communities around the project area.

Table 3-5: Plant Personnel of UAEL

Post/ personnel required for specific activities	No.
Plant Manager	1
Operation Manager	1
Shift in Charge	4
Shift Engineer	24
Junior Engineer	8
Cleaner	10
Chemist	1
Safety In Charge	1
Maintenance Manager	1
Mechanical Engineer	2
Asst. Mechanical Engineer	12
Helper	4
Senior Maintenance Electrical Engineer	2
Electrical Engineer	2
Asst. Electrical Engineer	4
Workshop Supervisor	1
Dismantling & Assembly	3
Turbocharger	4
Cylinder Head Assemble	3
Logistics & Workshop Manager	1
Warehouse Executive	1
Tools Store Executive	1
Admin & HR Officer	1
Safety Officer	2
Environmental Compliance	1
Accounts Officer	1
Security in Charge	1
Security Team	30
Driver	4
Gardener	9

It is reported that UAEL has leased a building at Ashuganj village, where accommodation is provided to all its staff except the local hires. The staff is provided with mess facility and transportation. It was also reported that a medical check-up of the staff is conducted at least once every year and at the time of joining. The UAEL has a tie up with a local Hospital, i.e., Day-Night Hospital and Diagnostic Centre which is about one km from the plant, for Medical emergencies. This facility has an ambulance, 15 beds and equipments to provide emergency medical services including surgeries. Brahmanbaria Eye Hospital is consulted for any medical aid related to eye.

3.4.3 Raw Material and Consumables

The main raw material for running the UAEL plant is Natural Gas. A total of 40 MMSCFD of gas is used for the power generation.

In addition, Lubricating Oil and Coolants are required as consumables. The lube-oil inside the engine is to be tested every 1000 running hour interval and depending on the parameters the oil will be

either sweetened or changed. UAEL plans to change oil every 1600 running hour interval based on their prior experience. Quantity of lubricating oil required for the plant is estimated to be 341640 litres per year. A total of 1635 drums of capacity 209 l will be required at the site per year.

Quantity of coolant required for the plant is about 6000 litre per annum (240 packs of 25 l capacity), to be used in the closed loop cooling cycle in the reciprocating engines. Some quantity is lost through evaporation in duty cycles and is made up from the make-up water tank (separate from the boiler make up water tank). During maintenance, the cooling water is accumulated in the make-up water tank, reducing wastage. Small quantities of lab chemicals are also required for the site.

3.4.4 Water Demand

Water will also be required for daily activities like drinking, washing, flushing, cooking, landscaping and cooling purposes. Both river and ground water are used for the plant activities (Table 3-6).

Table 3-6: Water Demand at UAEL Plant

S. No.	Activities	Water requirement (m^3/hr)	Source
1	Cooling Water	6000	River Water
2	DM Plant (for boiler make-up)	10	Groundwater
3	Cooking, Drinking, Flushing for 140 persons @45 litres per day	0.27	
4	Landscaping for 2.13 acres or 8620 m^2 @1 litre / m^2/d	0.36	
	TOTAL	6010.63	

The most significant water demand anticipated at the plant is for cooling of the condenser. For this purpose, 6000 m^3 of water is proposed to be sourced from the River Meghna per hour, i.e., 144000 m^3/d or 1.67 m^3/s. A barge mounted floating pump house has been placed on the Meghna River to supply cooling water to the plant through a 600 m long pipeline having diameter of 1.2 m (Figure 3-10 and Figure 3-11).

Packaged water is purchased from a local supplier for drinking purpose within the office building for technical and administrative staff. For human consumption (i.e., kitchen, drinking and flushing) a total of 6.3 KLD of water is required considering per capita demand of 45 litres per day.

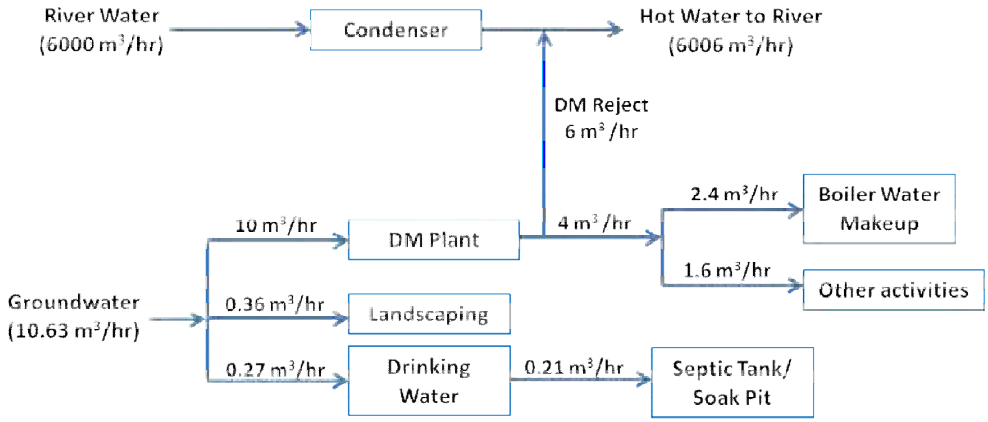
Other demands like drinking water for daily labourers, make-up water for boiler and landscaping are met from the groundwater. At present 10.63 m^3/hr of ground water is extracted through existing bore wells (2 in no.) at the site. The ground water is stored at a reservoir of 164 m^3 capacity. After DM treatment 4 m^3/hr is available, out of the which, 2.4 m^3/hr of DM water is utilised as make - up water to produce steam in the boilers and rest is utilised for consumption at the plant.

Water balance for the UAEL plant is presented in Figure 3-12.

Figure 3-10: Intake and Outfall Arrangement for UAEL

Figure 3-11: Intake (Left) and Outfall Joining Canal (Right)

Figure 3-12: Water Balance for UAEL



3.4.5 Wastewater Management

There are three main sources of wastewater in the plant, i.e., sewage, reject from DM plant and hot water from cooling system.

A total of 10 m^3/hr of groundwater is treated at DM plant to produce 4 m^3/hr of DM water and rest 6 m^3/hr is discarded as DM reject. All the cooling water mixed with reject from the DM plant (i.e., 6 m^3/hr) is discharged through a 1.2 m diameter pipe to an existing canal, at the distance of about 300 m east of the plant. This canal carries hot water from other power plants as well and discharges it to the Meghna River.

The quantity of municipal water generated at site will be 5 KLD, which is calculated as 80% of the water demand for cooking, drinking and flushing purposes. This wastewater is collected in a septic tank (with dimension 20' x 8' x 5') and only supernatant is sent to a soak pit with 5' diameter x 22' depth.

3.4.6 Waste Management

Considering a total of 140 persons working at the site, the total municipal waste produced at site is estimated to be approximately 42 kg per day (300 g/day/person), which will include paper waste, packaging waste and food waste. This municipal waste is proposed to be collected by Ashuganj Power Station Complex waste management authority (local authority) and shall be disposed off at a pre-determined waste disposal sites. The disposal points and fees are all the responsibility of Ashuganj Power Station Complex waste management authority (local authority).

Hazardous waste is also produced at site in the form of empty lube oil drums (1635 no/year) and coolant packs (240 no./year). This waste will be disposed off through government recognised vendor and records of the same shall be maintained at site.

4. DESCRIPTION OF THE BASELINE ENVIRONMENT

The understanding of the baseline environmental is essential to identify the existing natural environment of the area. This will also be helpful to assess if any potential impacts and changes, due to the development of any new project in an area on the environment. The environmental aspects, which are studied during the EIA study, include meteorology, ambient air quality, water quality, soil quality, noise levels and traffic and ecological conditions of the project impacted area.

4.1 Methodology for Establishing Baseline Conditions

The baseline setting of the study area was established as follows:

- An area of 2 km radius around the project site has been considered as the "study area" for evaluation of existing environmental status and identification of potential impacts.
- The existing land use of the study area of 5 km was studied based on the latest available satellite imagery and image processing techniques.
- Thorough literature review was performed to collect secondary data about the baseline of the area. Secondary data sources were used to study details on physiography, geology, geomorphology, drainage, groundwater scenario in the area.
- Meteorological data (2004 -2014) was procured from Bangladesh Meteorological Department to understand the long term trends in rainfall, relative humidity, temperature and wind speed.
- Baseline data used in the earlier EIA report is also presented in this chapter along with the results of primary environmental monitoring undertaken recently in the month of April and May, 2015.

4.2 Topography

Bangladesh has considerable topographic diversity. It has three distinctive features: (i) a broad alluvial plain subject to frequent flooding, (ii) a slightly elevated relatively older plain, and (iii) a small hill region drained by flashy rivers.

Most of the Bangladesh is low lying, delta plain formed due to the confluence of the Ganges (Padma), Brahmaputra (Jamuna), Meghna Rivers and their tributaries. The hilly areas of the south eastern region of Chittagong, the north eastern hills of Sylhet and highlands in the north and northwest are only exception and are at a higher elevation. The Chittagong Hills constitute the only significant hill system in the country. It rises steeply to narrow ridgelines (average 36m wide), with elevation ranges between 600 and 900m above mean sea level. In between the hilly ridges lie the valleys that generally run north to south. West of the Chittagong hills is a narrow, wet coastal plain lying parallel to the shoreline. It is important to note that the elevation at Ashuganj is around 6 -7 m above mean sea level.

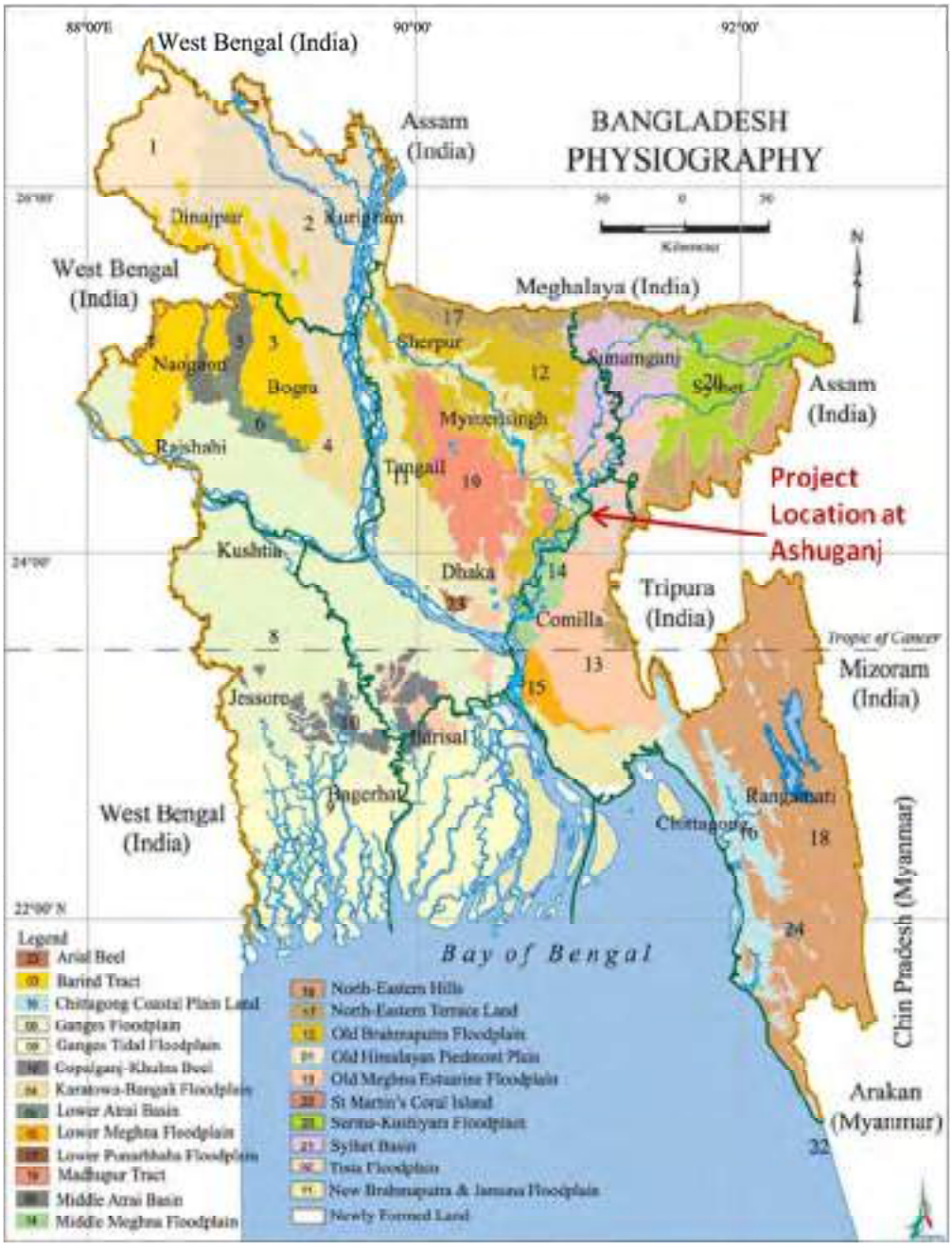
4.3 Physiography

Physiography is the terrain condition of a particular tract of land and reveals the surface condition of the land. Physiographic region/unit refers to a region in which all land tracts are similar in terms of physical characteristics, with a uniform geomorphic history and whose pattern of topographical features or landforms differs significantly from that of adjacent regions. In the context of

physiography, Bangladesh may be classified into three distinct regions (a) floodplains, (b) terraces, and (c) hills each having distinguishing characteristics of its own. The physiography of the country has been divided into 24 sub-regions and 54 units.

The project site falls under the Middle Meghna floodplain, which includes the main channel of the Meghna upstream from its junction with the Dhaleshwari and Ganges as far as Bhairab Bazar (Figure 4-1).

Figure 4-1: Physiographic Units of Bangladesh



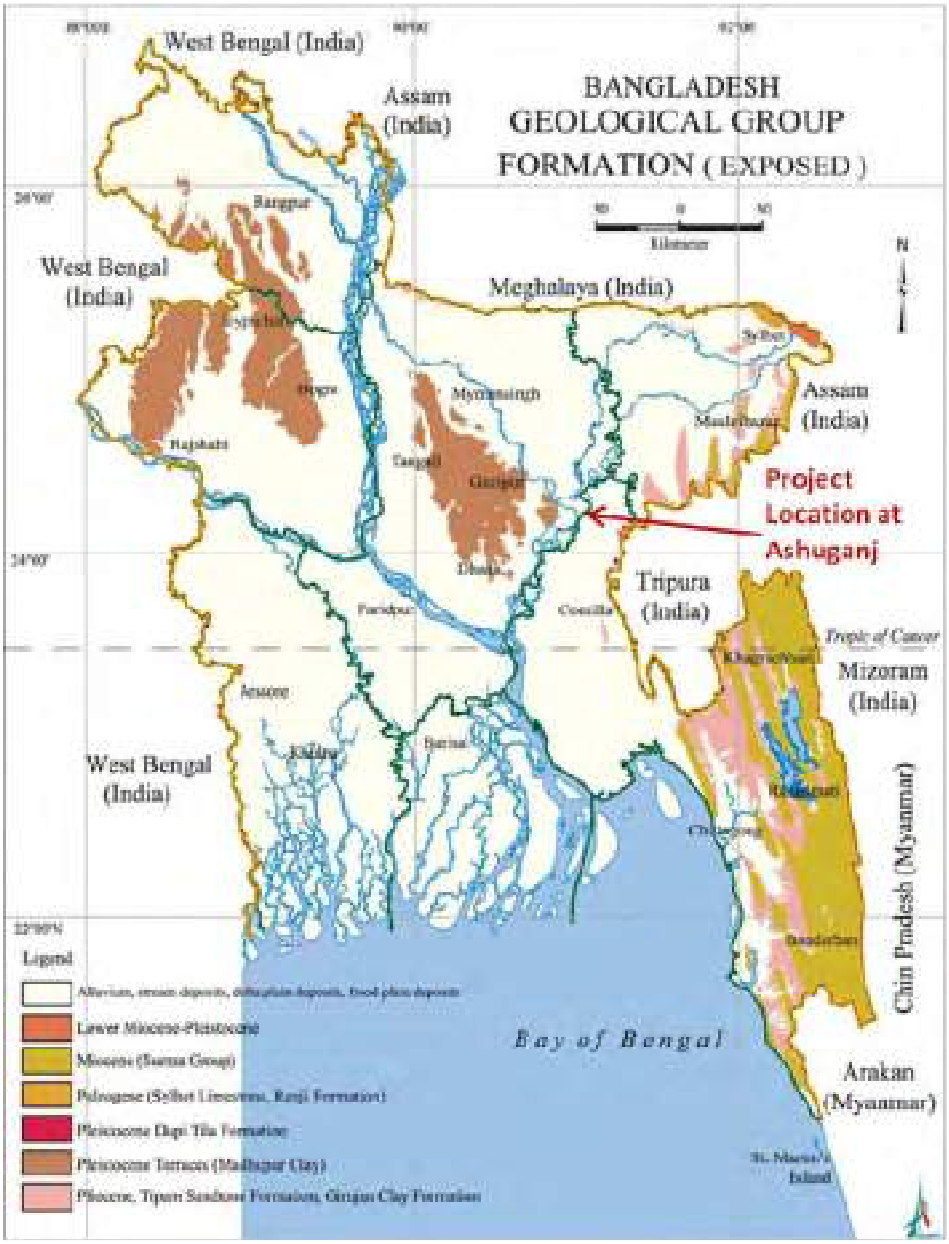
Source: National Encyclopaedia of Bangladesh

The floodplain of Meghna at this area occupies a low-lying landscape of broad islands and many broad meandering channels, which formed part of the Brahmaputra before it, abandoned this channel when it changed course into the Jamuna two centuries ago. The Meghna sediments are

mainly silty and clays and sandy Brahmaputra sediments occur at the surface on some ridges in the north.

The study area is characterised by the alluvium flood plain deposits (Figure 4-2). The alluvial soils in the Meghna Plain are generally fertile and enriched with heavy silt deposits carried downstream during the rainy season.

Figure 4-2: Geological Groups of Bangladesh



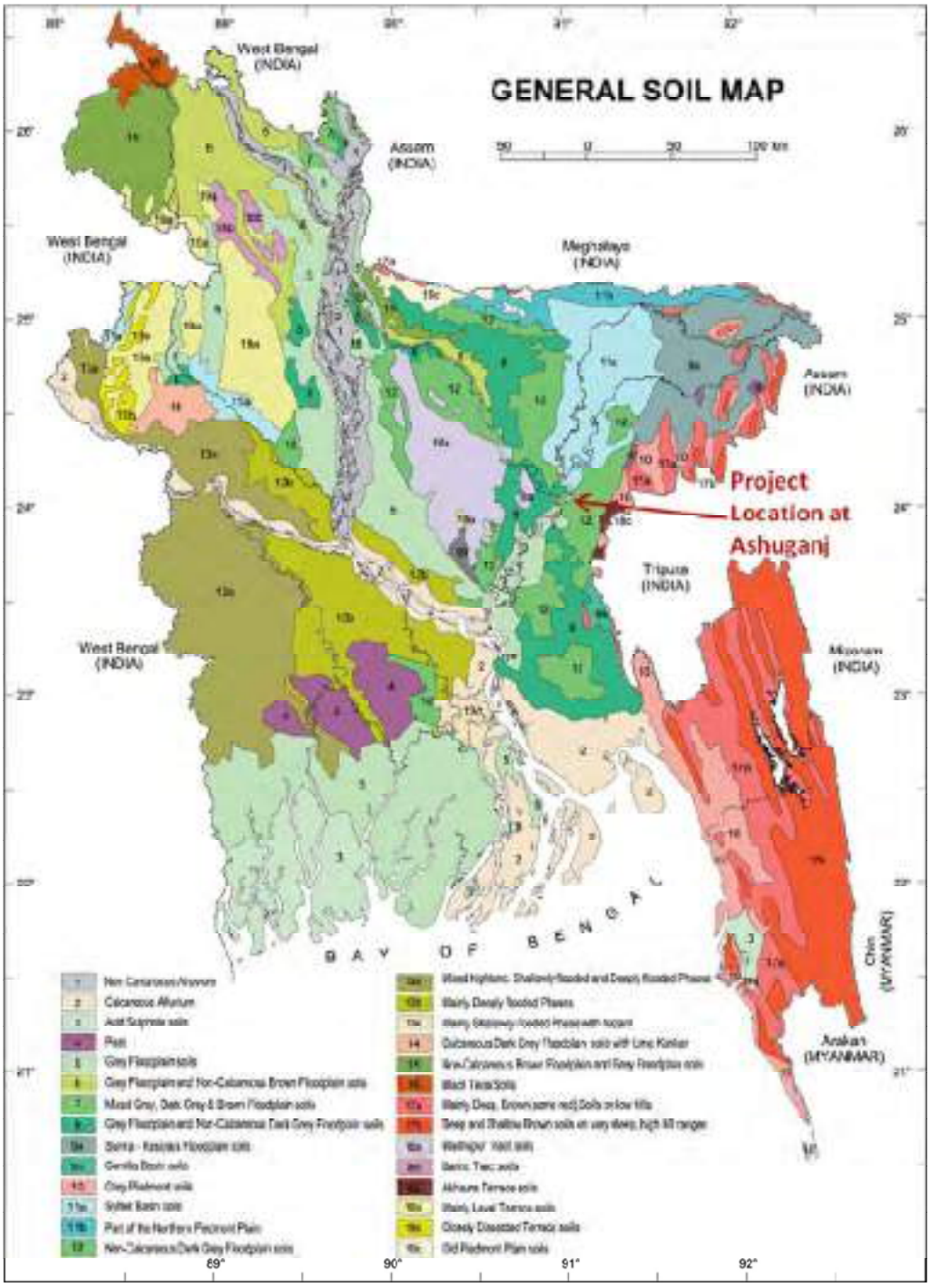
4.4 Geomorphology - Soil Types

Most of the area of Bangladesh is a vast, low-lying alluvial plain, sloping gently to the south and southeast. According to Bangladesh Agricultural Research Council's Agro-Ecological Zoning map of Bangladesh, the proposed project area falls in the Middle Meghna River Floodplain. This region occupies abandoned channel of the Brahmaputra River on the border between greater Dhaka and

Comilla districts. This region includes islands-former Brahmaputra chars within the Meghna River as well as adjoining parts of the mainland.

Soils of the project area are Non calcareous Dark Grey Floodplain soils (Figure 4-3). These are seasonally flooded soils developed to below 25 cm; not very strongly acidic throughout the upper 50 cm and not calcareous within 125 cm from surface.

Figure 4-3: General Soil Map of Bangladesh



4.5 Hydrogeology

The Ganges-Brahmaputra-Meghna delta system has the largest total sediment load in the world, eroded from the Himalayas and generating fluvio-deltaic sediment layers. The deposits of thick unconsolidated Pleistocene and Holocene alluvial sediments in this delta form one of the most productive fresh water aquifer systems in the world. Based on the principal geomorphological units, depositional environments and landforms in Bangladesh, the aquifers within the fluvial and deltaic areas of the country can be divided into three main types - upper shallow (or composite) aquifers, lower shallow (or main) aquifers and deep aquifers[7]. Each aquifer division has unique geological characteristics, thickness, soil types, transmissivity, etc.

The aquifer type and characteristics of the Chittagong Coastal Plain, in which the study area is located, is presented in Table 4-1. District wise aquifer test analysis conducted by Bangladesh Water Development Board (BWDB) show that the transmissivity of aquifers in Brahmanbaria district ranges from 450 – 780 m 2 /day while permeability ranges from 8-23 m/day[8] .

Table 4-1: Aquifer Types and Characteristics of the Groundwater Regions of Bangladesh

Physiographic Unit	Lithology	Thickness of Aquifer (m)/ Depth to Main Aquifer (m)	Type of the Aquifer
Coastal Plains of Chittagong: Plains that exists in between the folded hill ranges in the east and coastline in the west; characteristically flat and plain.	A 25 to 30 m thick zone of silt and clay covers the aquifer materials. Clay thickness gradually increases towards the Bar. Sandy materials are predominantly medium to coarse.	A shallow aquifer of about 20-50m thickness exists near the surface. Main aquifer is deep seated whose nature and extent are not known. Shallow aquifer exists at a depth of about 50m.	Semi-confined to confined.

Bangladesh Agricultural Development Corporation (BADC) has recently in 2010 undated groundwater zones map of Bangladesh (

Figure 4-4). It clearly shows that project area lies in a zone, where ground water level is less than 5.3 to 7.6 m deep. This is due to the location of the project area on the flood plain of river Meghna.

4.6 Hydrology

Ashuganj is situated on the left bank of river Meghna. It is the main source of water for the nearby villages as well as for Ashuganj industrial city. The available discharge data of river Meghna between 1998 and 2006, the lean flow generally varies between 2000 and 4500 m^3/s, which mean that even during low flow condition 2000 m3/s of water will be available at the river (Table 4-2). During monsoon the river discharge is around 10000m^3/s.

[7] Report on Arsenic Contamination of Groundwater in Bangladesh by British Geological Survey (http://www.bgs.ac.uk/research/groundwater/health/arsenic/Bangladesh/reports.html)

[8] Geological Setting Of The Areas of Arsenic Safe Aquifers, Ministry Of Local Government, Rural Development & Cooperatives (http://users.physics.harvard.edu/~wilson/arsenic/countries/bangladesh/National%20Water%20Policy%202003/Ground%20Water%20TAsk%20Force%202002/5-GWTF-Annex.pdf)

Figure 4-4: Ground water Zoning Map of Bangladesh

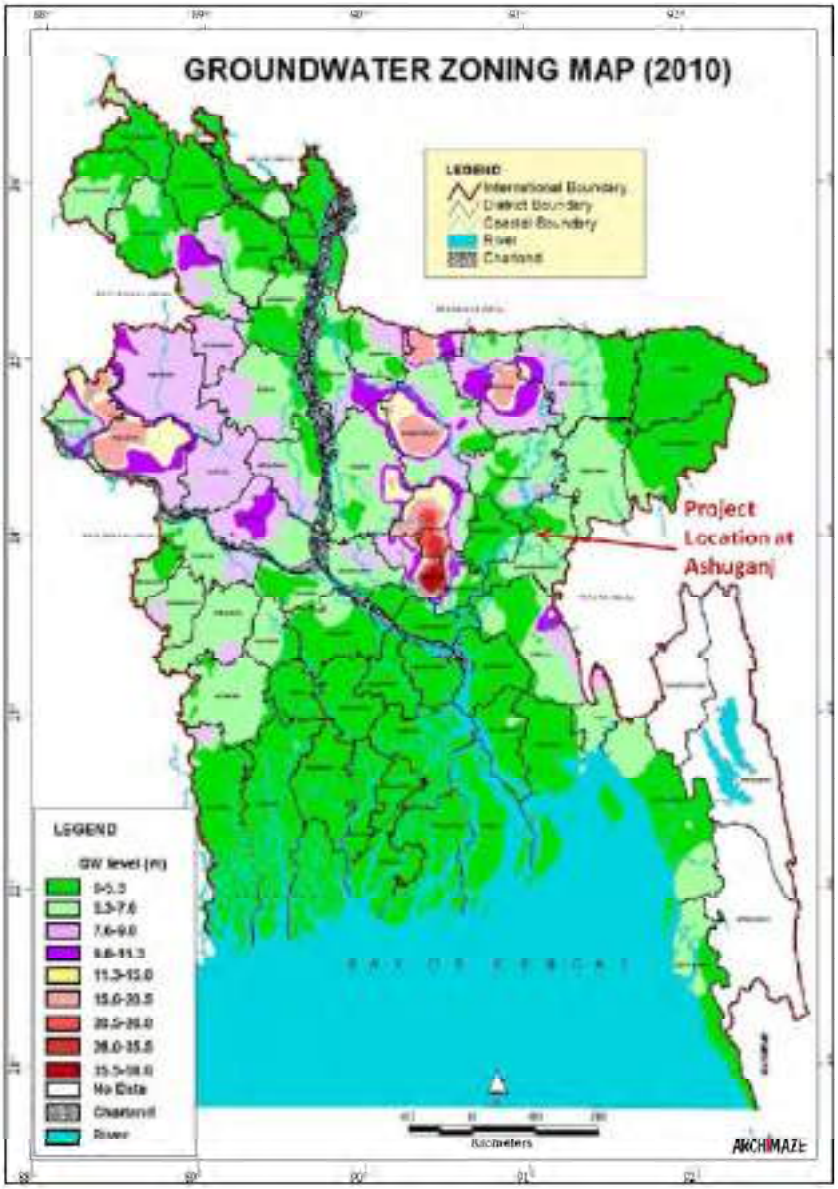


Table 4-2: Discharge of River Meghna, m^3/s

Year	Maximum	Minimum
1998	14669	2050
2000	12109	3197
2001	11630	3135
2002	16558	4448
2003	13229	2938
2004	10571	3742
2005	10786	3658
2006	9463	4230

Source: EIA, Bangladesh: Power System Efficiency Improvement Project, 2011, Prepared by the Ministry of Power, Energy and Mineral Resources for the Asian Development Bank (ADB).

At present, total water extraction from the Meghna River for all the APSCL power plants is 39 m^3/s (EIA, Bangladesh: Power System Efficiency Improvement Project, 2011). The UAEL plant will require additional water of 1.67 m^3/s.

4.7 Tectonic Setup

Bangladesh constitutes major parts of the Bengal Basin and has evolved by formation of successive delta systems developed by the two great rivers of the Ganges and the Brahmaputra. The Bengal Basin is a structurally complex area formed due to the presence of an active Himalayan folded belt (thrust belt) in the north and Indo-Burman fold belt in the east[9]. It is surrounded by the Archean (3.8 to 2.6 billion years old) Indian Platform (Shield) in the west, Tertiary (time range between 65 to 1.6 million years) and, in part, Mesozoic (225 to 65 million years) metamorphic Indo-

Burman ranges in the east and the Archean basement of the Shillong Plateau in the north.

Tectonically, Bangladesh is divided broadly into the following divisions, on the basis of basement behaviour and fault characteristics[10]:

a) Indian Platform and Shelf

It is sub-divided into three zones, i.e., (a) Dinajpur slope (Himalayan Fore Deep), which lies south of the Main Boundary Thrust (MBT) all along the foothills of the Himalayas. It lies at the NW tip of Bangladesh and the basement occurs at 2500 m depth; (b) Rangpur Saddle- The basement is most uplifted and covered with thin sedimentary deposits. The tentative boundary of the Rangpur Saddle at the northern and the southern slopes has been seismically defined by the approximately 700 m depth contour and (c) Bogra Slope- the Bogra Shelf (Bogra slope) represents the southern slope of the Rangpur Saddle which is a regional monocline plunging gently towards south east to the Hinge zone. This zone marks the transition between the Rangpur Saddle and the Bengal Foredeep.

b) Hinge Zone (Eocene slope break)

It is a narrow zone trending SSW-NNE from Sylhet-Mymensingh-Panba-Calcutta and further to the southwest along the coastline of Odisha. It is bound by the Bogra Shelf (or south slope of the Rangpur Saddle) by the seismic depth of 3500m to the top of the Eocene Sylhet Limestone, the most prominent sedimentary reflector in Bangladesh and West-Bengal.

c) Bengal Fore Deep

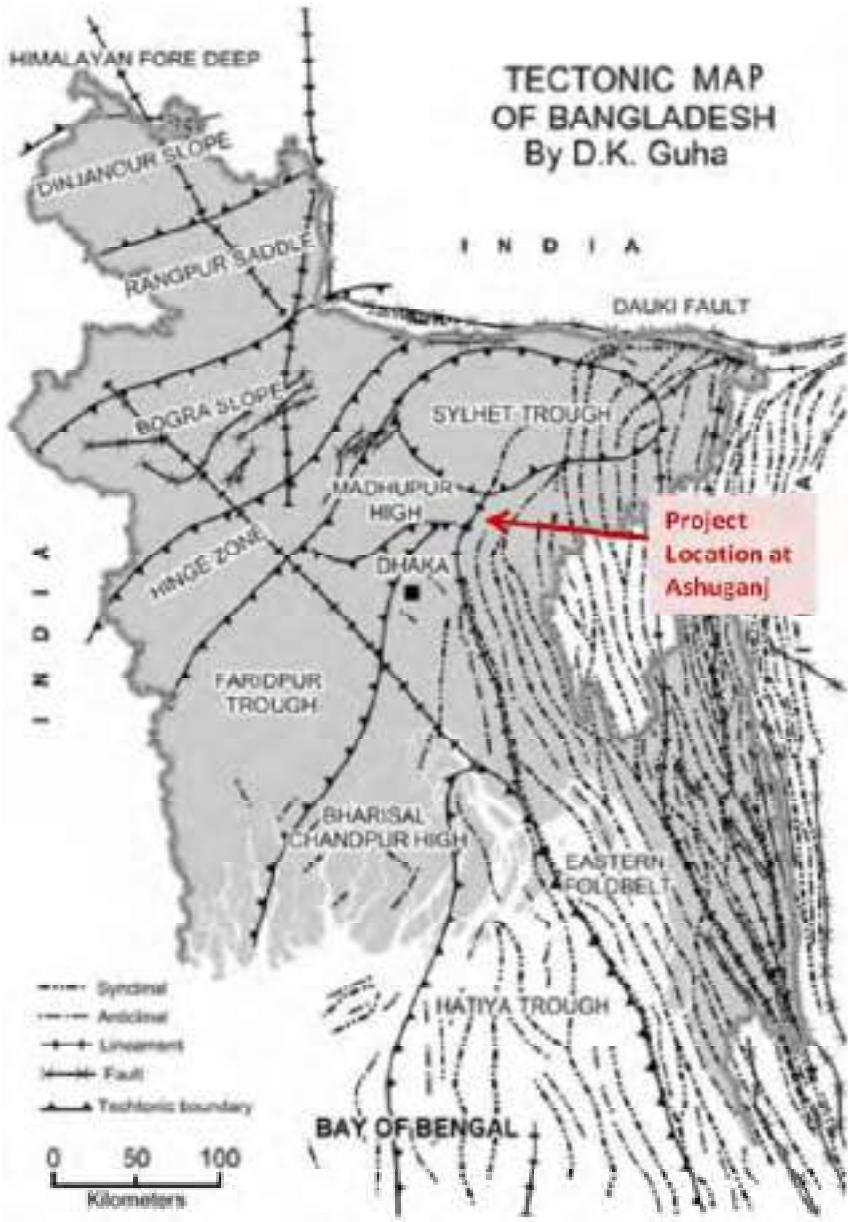
The Bengal Foredeep is flanked by Hinge Line in west and the Arakan Yoma Folded System in east which plays the most important role in the tectonic history of Bengal Basin. The Bengal Foredeep can be divided into two major regions: a Western Platform Flank and an Eastern Folded Flank. The Western Platform flank is further subdivided into the Faridpur Trough, the Barisal-Chandpur High, the Hatiya Trough, the Madhupur High and Sylhet Trough.

The Eastern Folded belt extends S-N within Bangladesh for 450 km and is about 150 km wide, covering an area of 35 000 km2 of on-shore area.

The location of Ashuganj is lies within the eastern fold (Figure 4-5).

[9] http://www.warpo.gov.bd/rep/knowledge_port/KPED/Forces/Geology/Tectonic_Setup.htm
[10] http://21.174.128.43/web_data/iga_db/Bangladesh.pdf

Figure 4-5: Tectonic Elements of Bangladesh



Source: Guha et.al, 2010; http://217.174.128.43/web_data/iga_db/Bangladesh.pdf

4.8 Natural Hazards

Natural hazards are severe and extreme weather and climate events and these cause severe damage to human life and property. Bangladesh is a low lying country and also located close to Himalayan plate which makes it flood and earthquake prone country.

4.8.1 Seismicity

The Bangladesh is divided into three seismic zones, i.e., I, II and III. The northern region is categorised as Zone I with seismic coefficient of 0.08 g, corresponding to maximum intensity of IX on modified Mercalli scale. The Zone I includes areas of Rangpur, Mymensingh, and Sylhet. The Zone-II covers region of Dinajpur, Bogra, Dhaka and Chittagong, it has seismic coefficient of 0.05 g and the shocks of intensity of VIII are possible. The southern part of the country, i.e., Zone III, is least

susceptible to earthquakes. The seismic coefficient of this zone is 0.04 and on Mercallis scale maximum intensity expected is VII. As shown in Figure 4-6, project area falls in Zone II.

Considering the high risk for earthquakes, the plant has been designed for seismic zone 2 (Annexure IX).

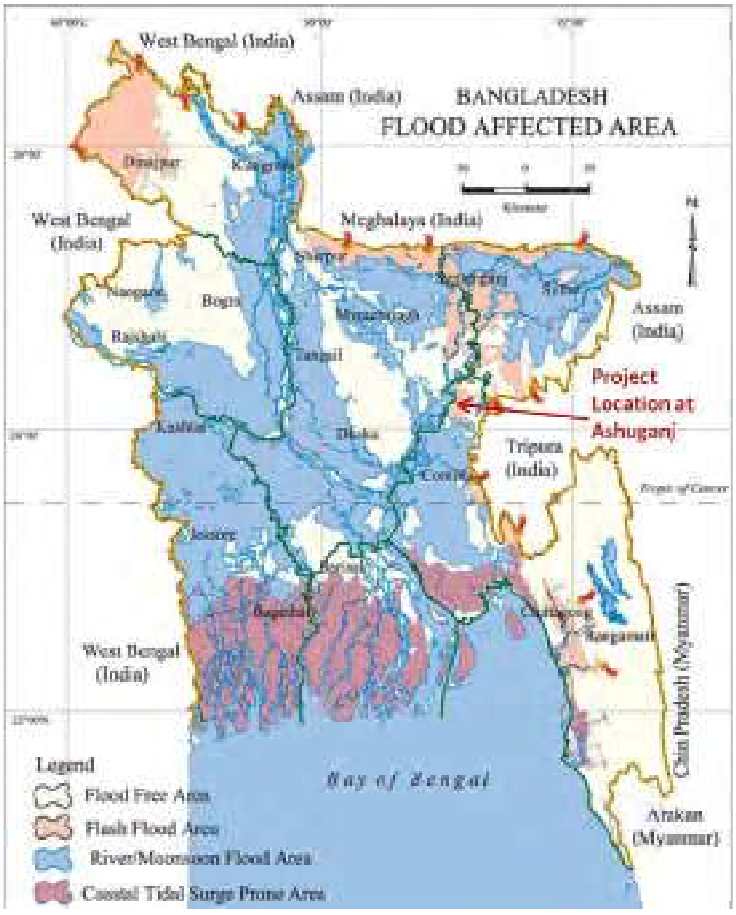
Figure 4-6: Earthquake Zones Tectonic Elements of Bangladesh

4.8.2 Floods

The location of Ashuganj on the low lying flood plains of Meghna makes it susceptible to monsoon and flash floods (Figure 4-7). As per the records of Flood Forecasting and Warning Centre, Bangladesh Water Development Board (BWDB), the recorded highest water level at B.Baria station at Upper Meghna is 7.78 mPWD[11]. The PWD datum is 0.46 m below the Mean Sea Level (MSL) datum, hence recorded highest water level would have been 8.24 msl.

The Institute of Water Modelling[12] carried out a flood forecast for the entire Ashuganj area and the report suggested that the ground elevation in and around the existing Ashuganj Power Station is higher than the peak water level of a high flood of 50 year return period. The proposed project land is also elevated to approximately 11 m over mean sea level. Moreover, the plant buildings are built about 1.5 m above the highest flood level of the region, the Gensets (Engines & Alternators) are placed on a common base frame of height 1.175 m from the engine hall floor. Further, the steam turbine and alternator are also located on the turbine hall floor where the ground floor to turbine floor height is 8 m, condenser for steam turbine is 2.4 m above the ground floor level. There is no basement at the project site. Thus, the desired protection has been taken to mitigate any event of flood based on previous data.

Figure 4-7: Flood Affected Areas of Bangladesh



[11] http://www.ffwc.gov.bd/

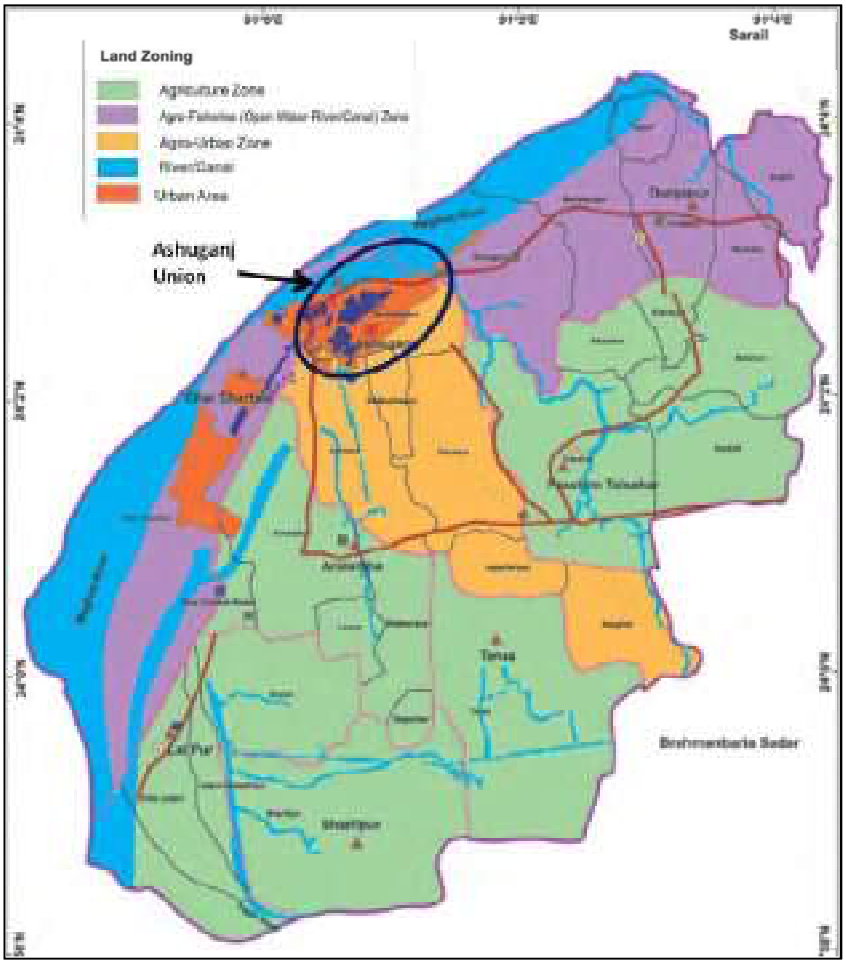
[12] APSCL, *Mathematical Modelling of the Meghna River in connection with the Proposed Ashuganj Power Station Master Plan and Related Services, prepared by Institute of Water Modelling, 2012.*

4.9 Land Use Pattern

The Ministry of Land in its 'Land Zoning Report for Ashuganj Upazila of August 2011, has provided details of the land use of all the eight unions, including Ashuganj Union, where UAEL project is located (Figure 4-8). The report mentions that Ashuganj Union comprised of eight mouzas having a total area of 1,133 Hectares (ha), of which the net cultivable land is 765.00 ha (67%) and the other land use are Urban Area (9%); Settlements with forest, gardens (12%) and water bodies (11%). The Ashuganj Union is hence categorised as Agro-Urban and Commercial Zone.

The total number of farmer's family is 3,351 of which about 32% are share croppers. About 84% areas are under irrigation using both surface and ground water. A total of 500 ha of land is under cultivations of High yielding rice variety – Boro and about 200 ha is used for cultivation of another rice variety, i.e., T. Aman. Jute is a Rabi crop in the region and is grown on about 40 ha. The cropping intensity of this union is 137%.

Figure 4-8: Land use of Ashuganj Upazila showing Ashuganj Union



4.9.1 Land use Mapping

The existing land use pattern of the study area was assessed through land use maps that were generated using available satellite imagery by AECOM. An area of 5 km from the proposed site was considered for preparation of land use and land cover map (LULC).

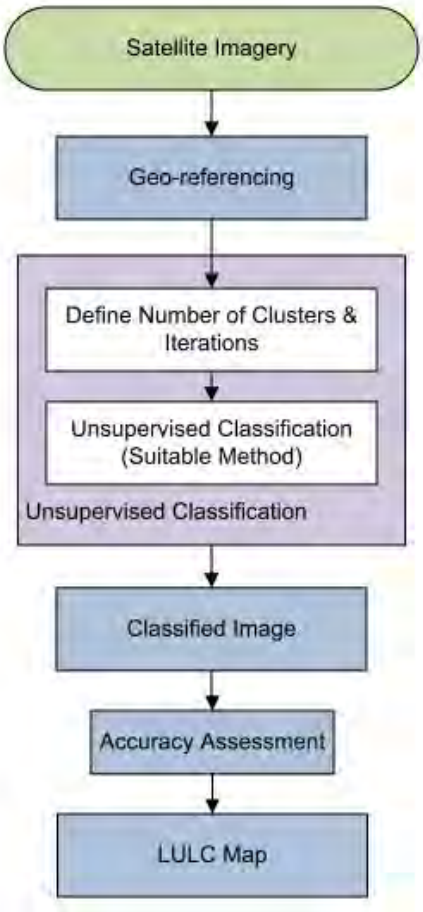
Visual and digital interpretation techniques were used to derive the land use/land cover information from the satellite imageries. The Imageries were geo-referenced into the Universal Transverse Mercator (UTM 46 N) coordinate system and 1984 datum used. 2nd order polynomial transformation was used to achieve higher accuracy in geo-referencing.

These images were processed in software namely ERDAS Imagine 10 and Arc GIS 10 for preparation of LULC maps using unsupervised classification method which have been shown in Table 4-3. A Flow diagram showing the steps that were taken to create land use/land cover mapping from satellite image is shown in Figure 4-9.

Table 4-3: Details of Software Used with their respective Functions

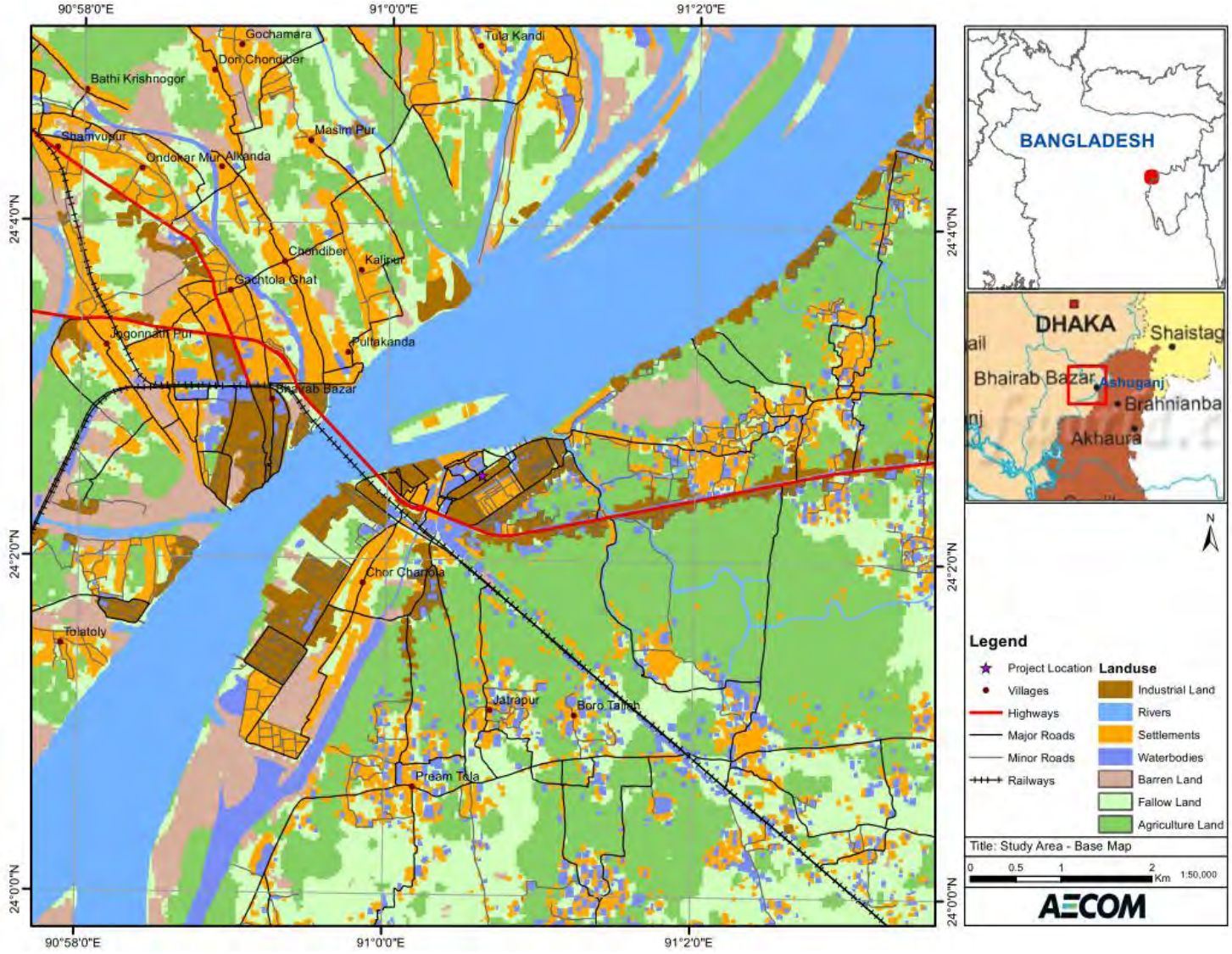
Software	Function
Arc GIS 10	Preparation of Vector Layer, Thematic map, Data Base Generation and Analysis
ERDAS Imagine 10	Layer Stag, Image Classification, Subset, Raster Analysis and Accuracy Assessment

Figure 4-9: Workflow Diagram



The results of land use analysis is provided covering eight different classes, i.e., dense vegetation, agriculture, built-up, water bodies and roads (Figure 4-10).

Figure 4-10: Land use Map with in 5 km Radius of the Project Site

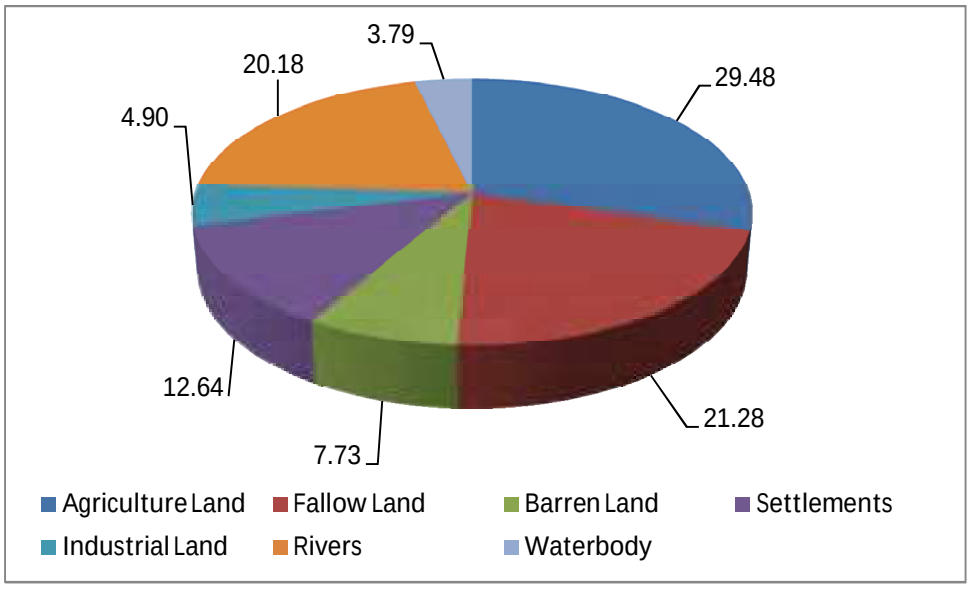


The most predominant land use is agriculture around the site, which occupies about 50 % of the total area (Table 4-4 and Figure 4-11). During the time of analyses, about 29 % was under cultivation and little more than 21 % was observed fallow. River and other water bodies (ponds and canals) occupy a total of 24 % of the land use. Industrial land use occupies about 5% of the total area, this includes entire Ashuganj Power station area and also the rice mills in the region. It is important to note that the category 'Barren area' has about 8 % of the land use, it covers land which is vacant for further industrial development near Ashuganj and also the flood plain of the stream where there is no agriculture activity.

Table 4-4: Percentage of Land Use within 5 km Radius

S.No	Land Use	Area in Sq.km	%
1	Agriculture Land	29.5	29.5
2	Fallow Land	21.3	21.3
3	Barren Land	7.7	7.7
4	Settlements	12.6	12.6
5	Industrial Land	4.9	4.9
6	Rivers	20.2	20.2
7	Water body	3.8	3.8
Total		99.9	100.0

Figure 4-11: Percentage of land use within 5 km radius



4.10 Climate and Meteorology

Bangladesh has a tropical monsoon climate with a distinct monsoon season during June-September, when the bulk of rainfall occurs. During pre-monsoon, i.e., March and May, high temperatures are observed in the entire country, from October onwards temperature starts decreasing and months between December and February are marked by cool and dry weather.

Meteorological data for 10 years between 2004 and 2013 had been acquired from Bangladesh Meteorological Department (BMD) for rainfall, humidity, temperature, wind speed and wind direction. The data was acquired for the nearest meteorological station at Dhaka.

4.10.1 Rainfall and Humidity

The annual rainfall varied between 1329 mm and 2885 mm during last 10 years. The year of 2012 was found to receive the lowest rainfall, while 2007 experienced the maximum (Table 4-5). As may be observed from Table 4-6, the minimum humidity is recorded in the months of February and March in various years (50 – 60 %). Generally the humidity is more than 65 % and in monsoon months the peak reaches as high as 82 %.

Table 4-5: Average Monthly Rainfall of Dhaka in last 10 years (source: BMD)

Year	Rainfall in mm												Annual Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2013	0	8	26	32	378	325	302	212	172	131	0	4	1590
2012	10	1	37	269	137	175	226	282	81	38	68	5	1329
2011	0	0	20	123	235	314	356	409	207	112	0	0	1776
2010	0	48	22	37	177	308	167	340	169	174	0	81	1523
2009	1	1	43	14	168	170	676	482	298	74	4	0	1931
2008	23	56	45	91	205	577	563	319	279	227	0	0	2385
2007	0	30	11	163	185	628	753	505	179	320	111	0	2885
2006	0	0	0	181	185	326	331	167	663	61	5	0	1919
2005	1	3	155	91	291	259	542	361	514	417	3	0	2637
2004	0	0	9	167	162	476	295	191	839	208	0	0	2347

Table 4-6: Average Monthly Relative Humidity of Dhaka in last 10 years (source: BMD)

Year	Monthly mean humidity												Annual Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2004	73	60	62	72	67	81	81	78	85	74	69	70	72
2005	68	60	66	66	73	79	81	82	81	80	72	66	72
2006	69	65	53	67	72	81	80	77	80	76	68	69	71
2007	68	68	54	69	70	81	84	80	80	78	77	69	73
2008	69	61	67	64	70	80	83	81	81	77	69	79	73
2009	72	55	53	66	72	74	80	82	81	73	66	69	70
2010	71	56	59	67	71	79	77	78	79	74	68	66	70
2011	69	54	57	64	76	80	79	82	77	73	67	73	70
2012	66	52	57	69	70	77	79	78	79	71	68	77	70
2013	65	55	55	63	78	76	77	80	81	78	66	72	70

4.10.2 Temperature

Bangladesh is located very close to the sea and also has a good network of river all across the region, due to which the temperatures do not vary a great deal. The monthly average temperatures were recorded to be in the range of 17 ^{0}C during January to 30^{0}C during May and June (Table 4-7). On close examination of minimum and maximum temperature it may be noted that minimum

temperature recorded decrease to as low as 8^0C in the month of January but maximum temperature still persists at more than 28^0C throughout the year.

Table 4-7: Temperature of Dhaka in last 10 years (source: BMD)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
Monthly average dry bulb Temperature (in degree Celsius)													
2004	18.2	21.8	27.1	27.8	30.4	28.5	28.6	29.1	27.7	26.9	23.4	21.0	25.9
2005	19.0	23.4	26.9	29.0	28.6	29.7	28.6	29.0	28.9	27.0	23.9	20.9	26.2
2006	18.9	24.9	27.4	28.6	29.1	29.1	29.2	29.1	28.5	27.9	24.3	20.6	26.5
2007	18.0	21.5	25.4	28.1	30.0	28.7	28.2	29.1	28.7	27.1	23.9	19.8	25.7
2008	19.0	20.3	26.6	29.2	29.3	28.7	28.5	28.8	28.9	27.1	23.7	20.4	25.9
2009	19.7	23.3	27.0	30.1	29.1	30.2	29.0	28.9	28.8	27.6	24.6	20.0	26.5
2010	17.6	22.3	28.2	30.4	29.7	29.3	29.7	29.5	28.9	28.3	24.9	20.1	26.6
2011	17.3	22.5	26.4	28.0	28.4	29.1	29.2	28.5	29.1	28.1	23.9	19.3	25.8
2012	18.9	22.1	27.1	28.1	30.1	29.7	29.1	29.2	29.0	27.9	23.5	18.4	26.1
2013	17.6	22.8	27.5	29.0	28.0	30.1	29.3	28.7	28.9	27.2	23.8	20.2	26.1
Monthly lowest minimum Temperature (in degree Celsius)													
2004	10.7	10.4	16.3	18.5	20.2	22.4	21.5	24.8	22.7	21.5	15.8	11.5	10.4
2005	11.4	11.5	19.0	19.6	19.7	22.5	24.0	24.3	23.8	20.8	16.0	12.2	11.4
2006	10.4	15.4	16.3	20.2	20.4	22.3	24.6	22.7	23.8	21.8	13.3	12.6	10.4
2007	9.6	12.6	15.0	18.1	22.5	22.0	23.4	24.2	24.5	19.5	16.8	11.3	9.6
2008	10.5	10.8	16.5	19.6	20.3	22.5	24.6	23.6	24.4	18.0	16.3	13.0	10.5
2009	11.1	12.2	15.8	20.4	21.6	22.6	24.4	24.3	24.5	20.6	15.2	11.4	11.1
2010	9.6	12.0	18.4	20.8	21.3	23.2	25.3	25.0	24.8	21.5	16.6	11.0	9.6
2011	8.2	13.0	16.0	20.2	21.3	23.2	23.9	24.5	23.7	22.0	17.2	11.0	8.2
2012	10.5	12.2	18.3	19.0	20.5	23.2	25.2	24.4	24.9	20.3	14.8	9.6	9.6
2013	7.2	14.0	16.7	19.8	20.0	22.0	24.5	24.5	24.2	20.1	16.0	11.8	7.2
Monthly highest maximum Temperature (in degree Celsius)													
2004	27.5	32.8	35.7	35.2	38.1	35.2	34.5	34.6	34.0	34.5	31.1	29.4	38.1
2005	28.5	32.1	35.6	37.0	36.4	36.6	33.7	34.0	35.1	34.6	31.4	29.0	37.0
2006	28.2	35.9	38.5	37.1	36.8	35.0	35.6	35.2	35.7	34.7	32.6	30.1	38.5
2007	28.8	30.8	36.7	35.9	37.5	35.9	34.8	35.9	34.9	35.6	31.8	28.2	37.5
2008	29.0	30.6	34.6	36.9	36.7	35.4	34.0	36.0	34.8	34.8	32.3	29.0	36.9
2009	28.1	33.9	36.0	39.6	37.8	36.5	35.7	34.3	35.3	35.8	33.9	29.0	39.6
2010	29.0	31.2	37.3	37.9	36.9	35.8	35.1	35.1	34.0	35.7	33.2	29.7	37.9
2011	27.8	31.0	34.5	35.8	35.3	36.0	35.4	35.0	36.2	34.5	32.4	30.0	36.2
2012	28.5	33.0	37.3	37.1	36.2	36.7	34.3	34.5	36.5	34.4	32.4	28.5	37.3
2013	28.1	32.4	36.0	37.0	37.1	36.4	34.6	35.0	35.7	35.2	32.1	30.5	37.1

4.10.3 Wind Speed and Wind Direction

Table 4-8 shows that monthly average wind speed varies from 2 knots to 6.3 knots in various months in last 10 years (1 kn = 0.51 m/s). Maximum wind speed is observed during the months of May and April and also during two months of September and October. High wind speed during October and November could be due the cyclonic conditions during that season.

The most predominant wind directions were found to be West (W) and North-West (NW) during January and February months. Between March and June winds mainly blows from Southern (S) direction. South and South East (SE) are predominant directions during three months of July to September. The month of October showed marked variation in the directions and winds were found

to be from South East (SE) to North (N). During November and December winds are again predominantly blowing from N and NW.

Table 4-8: Monthly Prevailing Wind Speed (knots) and Direction of Dhaka in last 10 Years

	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Jan	WS	3.5	4.1	3	2.9	3.6	3.3	2.9	2.2	2.4	2.3
	WD	W	NNW	N	NW	N	W	NW	W	W	W
Feb	WS	3.9	4.3	3.6	3.1	3.2	4.1	3.3	2.4	3	2.2
	WD	W	W	S	NW	N	W	W	W	W	W
Mar	WS	5.6	4.6	5	4.2	3.8	4	3.8	3.8	2.5	2.6
	WD	S	S	NNW	NW	S	W	S	S	S	W
Apr	WS	5.9	4.5	3.8	3.8	3.4	4.1	4.1	2.4	2.6	2.8
	WD	S	S	S	S	S	S	S	S	S	S
May	WS	5.5	4.4	3.8	3.5	3.4	3.8	3.7	3	2.5	3.2
	WD	S	S	S	S	S	S	S	S	S	E
Jun	WS	3.6	4.4	2.1	3.1	3.3	3.1	3	2.7	3	2.3
	WD	S	SE	S	S	S	S	S	SE	S	S
Jul	WS	4.3	4.6	2.2	3.1	3.4	4.3	2.4	2.4	2.7	2.7
	WD	SE	SE	SE	S	S	SE	S	SE	SE	SE
Aug	WS	4.1	3.5	4.5	3.1	2.8	2.8	2.2	2.4	2.5	2.7
	WD	SE	S	SE	S	S	S	S	SE	SE	SE
Sept	WS	6.3	4.6	5.4	3.2	2.8	4.2	2.6	2.6	2.2	2.2
	WD	E	SE	SE	S	S	SE	SE	SE	E	S
Oct	WS	4.2	4.8	2.3	4.1	9.6	2.3	2	2	2	2.9
	WD	SE	SE	N	NE	NE	E	NE	NW	S	SE
Nov	WS	3.2	3.4	2.1	5.5	2.5	2.8	2.9	2.3	2.2	2.1
	WD	W	NW	NW	NE	NE	N	N	W	W	N
Dec	WS	3.3	3.7	2.4	2.9	3.3	2.4	2.4	2.1	2.3	2.3
	WD	NNW	NNW	NW	NW	W	NW	N	NW	W	W

4.11 Environmental Monitoring

This section provides monitoring results of earlier studies conducted in the area and also the recent monitoring conducted by Bangladesh Atomic Energy Commission (BAEC) and UAEL in March 2015 and April, 2015 (Table 4-9).

Table 4-9: Data Sources and Period for Monitoring

Parameter	Data Sources	Period
Air	• For this report by BAEC	• 5 March to 31 March 2015
Noise	• AECL Lab (Earlier EIA report) • For this report by BAEC	• 25 February, 2012 • 5 March to 31 March 2015
Water	• AECL Lab (Earlier EIA report) • For this report by SGS	• 18 May, 2013 • 20 April, 2015
Soil	• For this report by SGS	• 20 April, 2015

4.11.1 Ambient Air Quality

The existing ambient air quality of the study area was monitored at one location (down wind direction) at the plant gate between 5th and 31st March, 2015 by the experts of (Bangladesh Atomic

Energy Commission (BAEC) and during this time plant was under trial run at full capacity. The monitoring parameters included Particulate Matter (SPM/Dust, PM_{10} and $PM_{2.5}$), Nitrogen-di-Oxide (NO_2), and Carbon Monoxide (CO). All the parameters were monitored on 24-hourly basis except NO_2 and CO during the duration of the study.

The particulate and gaseous samples collected during the monitoring have been analyzed as per the procedures specified in Table 4-10. The geographical location of the ambient air quality monitoring site was 24° 2.500' N, 91° 0.591' E.

Table 4-10: Methodology for Analysis of Ambient Air Quality

S. No.	Parameter	Analysis procedure
1.	SPM/Dust	Gravimetric method (AirMetric MiniVol sampler)
2.	PM10	Gravimetric method (AirMetric MiniVol sampler)
3.	PM2.5	Gravimetric method (AirMetric MiniVol sampler)
4.	NOx	Colorimetric method at 540 nm using spectrophotometer (Jacob and Hochheiser method)
5.	CO	Digital CO meter

The monitored ambient air quality data is summarized in Table 4-11.

Table 4-11: Ambient PM_{10}, $PM_{2.5}$, NO_2 and CO concentration

Sampling Date		SPM	PM10	PM2.5	NOx	CO
		24h average (µg/m^3)			mg/m^3 (1h average)	
3/5/2015		249	153	55.8	0.081	4.85
3/8/2015		340	219	105	0.085	5.73
3/11/2015		609	369	129	0.076	3.44
3/14/2015		645	386	180	0.096	4.85
3/16/2015		450	254	186	0.086	4.85
3/19/2015		246	183	114	0.093	5.15
3/21/2015		524	317	196	0.072	4.01
3/23/2015		784	350	163	0.098	4.01
3/25/2015		507	258	126	0.075	3.44
3/27/2015		353	197	102	0.088	3.44
3/29/2015		317	246	129	0.066	2.86
3/31/2015		185	147	69.4	0.059	4.01
BNAAQS	24h avg.	-	150	65	-	40 (1hr Avg)
	Annual	-	50	15	0.1	-
WHO	1 hr	-	-		0.2	
	24h avg.	200-230	50	25	-	
	Annual	-	20	10	0.04	-

***The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*

****Who Ambient Air Quality Guideline Values (2005 and 2000), which are also being referred in the World Bank Group General Guidelines (2007)*

The SPM concentration recorded at site ranges between 185 and 784 µg/m^3, which is quite higher that the WHO limit of 230 µg/m^3. There are no standards in Bangladesh for SPM. The other two parameters of dust, PM_{10} and $PM_{2.5}$ are also higher than the BNAAQS and WHO standards. The higher dust emissions recorded at the site is may be due to the ongoing construction activities and

also the operation of the rice mills. The predominant wind direction during March month is South and on the Southern side of the plant two 450 MW power plants of APSCL are under construction and several rive mills are also located in that area.

The 1-hourly NOx concentration was recorded in the range of 0.059-0.098 mg/m^3. During the monitoring period, the maximum NOx concentration is reported at power plant site is 0.098 mg/m^3. In absence of 1-hourly standard for Bangaldesh the monitoired values are compared with the WHO standards and it may be observed that the NOx concentrations are well within the WHO standard (0.2 mg/m^3).

The 1-hourly CO concentration was recorded in the range of 2.86 – 5.73 mg/m^3. Average concentrations of CO are reported low at the monitoring location while comparing with the Bangladesh Standard of are 40 mg/m^3.

Table 4-12 provides averages and standard deviation of the measured parameters. Air monitoring and analyses methodology is provided in Annexure X.

Table 4-12: Average and Standard Deviation of Measured Parameters

Pollutant	Averaging Time	Who Guidelines	Proposed Bangladesh Standards	Average ± Std. Deviation
PM_{10}	24 hour	---	150 μg/m^3	257± 83 μg/m^3
	Annual	---	50 μg/m^3	233±124 μg/m^3
$PM_{2.5}$	24 hour	---	65 μg/m^3	130 ±45 μg/m^3
	Annual	---	15 μg/m^3	84± 49 μg/m^3
NO_2	1 hour	0.2 mg/ m^3	---	0.081±0.012 mg/m^3 (1 hour)
CO	1 hour	30 mg/m^3	40 mg/m^3 (35 ppm)	4.22±0.86 mg/m^3 (1 hour)

N.B.: It should be noted here that the PM data are sampled and tested by the Reputed Atomic Energy Centre, Dhaka (AECD). Dr. Bilkis Ara Begum, Chief Scientific Officer, Chemistry Division, Atomic Energy Centre, Dhaka has tested and analyzed the data with due diligence.

4.11.2 Noise Quality

Noise levels were recorded at six locations in the study area during 5 March to 31 March 2015 and during this time the plant was under test operational run at peak capacity. Noise levels were recorded in the form of sound pressure levels with the help of a digital sound level meter. Noise levels were recorded 3 times in 24 h (every eight hours intervals; 6 am, 2 pm and 10 pm). The details of noise monitoring locations are given in Table 4-13. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. The sound level is recorded in form of A-weighted equivalent continuous sound pressure level (Leq) values with the use of A-weighting noise measuring instrument.

Table 4-14 summarizes the measured ambient noise levels at each monitoring location. The project area falls into Industrial zone according to Bangladesh Environmental Quality Standard ECR'97 categorization. Noise levels of all locations were within the standard limit of ECR'97 (subsequent amendment in 2006), except one location in the southern direction.

It is important to note that monitoring location on the Northeast is close to engine hall and shows that noise levels at that location are within the standards. High noise levels at the locations Southern could be attributed to the operation of the Aggreko International Projects Ltd, traffic and construction activities going on for the the two 450 MW plants of APSCL in the South.

Table 4-13: Locations of noise monitoring sites

Direction	Location	Location Setting
South	24°2.445' N; 91°0.589' E	Aggreko
Extended South	24°2.416' N; 91°0.707'E	APCL Residential area
Northeast	24°2.563' N; 91°0.692'E	Near Engine hall entry
Southeast	24°2.539' N; 91°0.721'E	Training Centre
Southwest	24°2.432' N; 91°0.564'E	Aggreko
Northwest	24°2.453' N; 91°0.532'E	Canteen

Table 4-14: Average Noise Level at the Plant Area

Direction	10am	2pm	10pm
	dBA		
South	75.6±3.2	75.3±3.3	75.7±3.4
APSCL Residential Area	60.1±2.2	60.7±2.4	60.6±3.1
Northeast	68.7±5.0	68.2±5.2	64.6±6.5
Southeast	72.7±3.7	72.6±2.9	73.6±3.8
Southwest	70.3±3.4	68.2±8.3	64.4±10.5
Northwest	64.5±3.4	64.8±3.0	66.7±4.2
ECR 1997 (Industrial area)	75	75	70

The monitoring carried out by AECL during 25th February, 2014 also provided similar results (Table 4-15). The noiselevel before the construction and opartion of UAEL plant was also found to vary between 63 and 76 dB (A). Noise levels were recorded to be lower than standards during both day and night times except one intacnce.

Table 4-15: Hourly Noise Level within the Plant Area near Office on 25th Feb, 2014

S. No.	Time	Minimum	Maximum	Average	Remark
1	6:00 AM	59.4	71.3	69.2	Noise Source from near power plant activities
2	7:00 AM	60	77.8	69.17	Noise Source from near power plant activities
3	8:00 AM	55.8	80.3	74.44	Maximum noise source from project construction & power plant activities
4	9:00 AM	60.4	71.4	69.26	Maximum noise source from project construction & power plant activities
5	10:00 AM	65.4	82.2	73.12	Maximum noise source from project construction & power plant activities
6	11:00 AM	60.8	77.8	76.19	Maximum noise source from project construction & power plant activities
7	12:00 PM	61.1	81.5	72.18	Maximum noise source from project construction & power plant activities
8	1:00 PM	58.3	77.2	75.12	Maximum noise source from project construction & power plant activities
9	2:00 PM	62	79.6	72.19	Maximum noise source from project construction & power plant activities
10	3:00 PM	66.3	88	69.11	Maximum noise source from project

S. No.	Time	Minimum	Maximum	Average	Remark
					construction & power plant activities
11	4:00 PM	62.7	78	68.16	Maximum noise source from project construction & power plant activities
12	5:00 PM	61.3	85	73.39	Maximum noise source from project construction & power plant activities
13	6:00 PM	62.8	82.7	69.44	Maximum noise source from project construction & power plant activities
14	7:00 PM	66.4	79.2	68.13	Maximum noise source from project construction & power plant activities
15	8:00 PM	60.9	84.8	69.23	Maximum noise source from project construction & power plant activities
16	9:00 PM	66.7	88.2	67.33	Noise Source from near power plant activities
17	10:00 PM	63.8	79	66.44	Noise Source from near power plant activities
18	11:00 PM	58	87.2	65.19	Noise Source from near power plant activities
19	12:00 AM	61.4	77.8	66.34	Noise Source from near power plant activities
20	1:00 AM	62.2	76.9	65.16	Noise Source from near power plant activities
21	2:00 AM	61.2	74.2	63.74	Noise Source from near power plant activities
22	3:00 AM	58.2	75.9	64.82	Noise Source from near power plant activities
23	4:00 AM	62.2	75.8	67.18	Noise Source from near power plant activities
24	5:00 AM	59	76	69.19	Noise Source from near power plant activities
Bangladesh (DoE) Standard					
Industrial Area			75 (Day)		70 (Night)

4.11.3 Surface Water Quality

All the power plants operating in the region are extracting water from Meghna River for cooling purposes and the hot water is discharged back to the canals running across the Ashuganj to be finally discharged to River Meghna. Thus, it was important to assess the quality of river and ground water to establish a baseline.

The surface water sample was collected on 20th April, 2015 from river Meghna and was sent to the SGS Labs, Bangladesh for analyses (Test report is attached as Annexure XI). Earlier AECL collected sample from a nearby pond and analyses of surface water in May 2013. The results of both the monitoring is presented in Table 4-16.

Table 4-16: Surface Water Quality

Test items	Method	Sample -Meghna River on 20th April, 2015	Sample - nearby Pond on, 18th May, 2013*
Total Coliform	APHA 21st Edition 2005 (9221 B)	6 MPN/100 ml	-
Faecal Coliform	APHA 21st Edition 2005 (9221 E)	< 2 MPN/100 ml	-
pH	APHA 22nd Edition 2012 (4500 H^+B)	6.78 at 25 ^{0}C	7.9
Conductivity	APHA 22nd Edition 2012 (2510 B)	142.3 µs/cm	192
Colour	APHA 22nd Edition 2012 (2120 C)	20 pt-Co	
Turbidity	APHA 22nd Edition 2012 (2130 B)	12.55 NTU	54 NTU
Temperature	APHA 22nd Edition 2012 (2550 B)	23° C	26° C
Total Suspended Solids	APHA 22nd Edition 2012 (2540 D)	8.0	28
Total Dissolved Solids	APHA 22nd Edition 2012 (2540 C)	38.0 mg/l	96
Dissolved Oxygen	APHA 22nd Edition 2012 (4500-O G)	5.7 mg/l	6.5
Biochemical Oxygen	APHA 22nd Edition 2012 (5210 B)	ND	4.11

Test items	Method	Sample -Meghna River on 20th April, 2015	Sample - nearby Pond on, 18th May, 2013*
Demand		(LOD: 1.0mg/l)	
Oil and Grease	APHA 22nd Edition 2012 (5520 B)	ND (LOD: 1.0mg/l)	0.57
Chemical Oxygen Demand	APHA 22nd Edition 2012 (5220 B)	ND (LOD: 4.0mg/l)	12
Chloride	APHA 22nd Edition 2012 (4500 Cl^- B)	3.97 mg/l	4.11
Total hardness	APHA 22nd Edition 2012 (2340 C)	50 mg/l	
Total alkalinity	APHA 22nd Edition 2012 (2320 B)	50 mg/l	
Nitrate	APHA 22nd Edition 2012 (4500-NO_3 B)	1.25 mg/l	1.24
Sulphate	APHA 22nd Edition 2012 (4500-SO_4^{2-} E)	16.88 mg/l	0.24
Total Phosphate	APHA 22nd Edition 2012 (4500-P B & E)	ND (LOD: 0.46 mg/l)	0.5
Calcium	APHA 22nd Edition 2012 Optical Emission Spectrometery by ICP-OES	12.06	
Iron	APHA 22nd Edition 2012 Optical Emission Spectrometery by ICP-OES	0.87	
Manganese	APHA 22nd Edition 2012 Optical Emission Spectrometery by ICP-OES	3.65	1.32

Note: ND- Not Detected, LOD- Lower Detection Limit

** Monitoring and Analyses carried out by AECL Lab (water collected on 18.05.2013 and tested on 23.05.2013)*

The recent monitoring results were compared with DoE Standards for inland surface water (Table 2-12) and it was found that water is suitable for all the purposes except for drinking without treatment as DO content is less than 6 mg/l. While the earlier results have shown that the pond water had a BOD of more than 4 mg/l and hence it is not fit for drinking without treatment and for any recreational activity. Though is good for fishing, industrial purposes and irrigation.

In addition to these heavy metals were also analysed and all heavy metals were not detectable in the surface water samples. The metal analysed were Arsenic, Cadmium, Chromium, Mercury, Lead and Zinc. The concentration of all the parameters were also well within the standards for the monitoring carried out during May 2013 data.

4.11.4 Ground Water Quality

According to Bangladesh Water Development Board, the ground water level of Ashuganj Upazila is about 7.0 m. Ground water is the source of water for domestic use in this area. In order to determine quality of ground water, water sample was collected from the tube well of the existing plant of the company and analyzed for different parameters. The ground water sample were also collected from an existing bore well at the site; recently on 5th May, 2015 was analysed at the Bangladesh University of Engineering and Technology, BUET (Test report is attached as Annexure XII) and earlier monitoring was done by AECL in May 2013.

The results shows that all the parameters are in conformance with the allowable limit of drinking water as per as the Bangladesh Standards for Drinking Water (ECR'97) and WHO guidelines (Table

4-17). Total and Faecal coliforms numbers were observed in higher numbers in the ground water samples of the project site, suggesting faecal contamination. People at the site reported to consume the ground water and have also reported water borne diseases. This is attributable to the absence of drainage system, open defecation, combined with easy percolation of contaminated water to the ground water which is available at shallow depths.

Table 4-17: Ground Water Quality

Test items	Bangladesh Standards for Drinking Water (ECR'97)	WHO guideline Value 2004	Result May, 2015**	Results, 18th May, 2013*
Total Coliform (TC) (CFU/100ml)	0	0	28	Nil
Faecal Coliform (FC) (CFU/100 ml)	0	0	16	Nil
pH	6.5-8.5	6.5-8.5	6.64	7.16
Colour (Hazen)	15	15	8	
Turbidity (NTU)	10	5	1.1	0.24
Total Dissolved Solids (TDS) (mg/l)	1000	1000	344	124
Total Hardness (mg/l)	200-500	200	42	78
Total Alkalinity (mg/l)	-	-	-	36
Chloride as Cl (mg/l)	150-600	250	134	-
Manganese as Mn (mg/l)	0.1	0.4a, 0.1b	0.094	-
Arsenic as As (mg/l)	0.05	0.01	0.006	-
Iron as Fe (mg/l)	0.3-1.0	0.3	0.26	-

** Monitoring and Analyses carried out by AECL Lab (water collected on 18.05.2013 and tested on 23.05.2013)*

*** Analysis carried* out by Bangladesh University of Engineering and Technology (BUET), sample collected and supplied by UAEL

4.11.5 Soil

A soil sample from the project site was collected on 20th April 2015 and analysed by SGS Labs, Bangladesh. The results of the analyses are as presented below (Table 4-18) and test reports are provided as Annexure XIII.

Table 4-18: Soil Quality

S. No.	Parameters	Method	Soil sample result
1.	Lead (mg/l)	US EPA 3052; Optical Emission Spectrometry by ICP-OES	8.70 (LOD: 5 mg/l)
2.	Cadmium (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	ND (LOD: 5 mg/l)
3.	Chromium (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	43.94 (LOD: 5 mg/l)
4.	Copper (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	71.31 (LOD: 5 mg/l)
5.	Potassium (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	21621.0 (LOD: 5 mg/l)
6.	Iron (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	21008.0 (LOD: 5 mg/l)
7.	Nickel (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	21 (LOD: 5 mg/l)
8.	Zinc (mg/l)	US EPA 3052	71.0

S. No.	Parameters	Method	Soil sample result
		Optical Emission Spectrometry by ICP-OES	(LOD: 5 mg/l)
9.	Arsenic (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	11.0 (LOD: 5 mg/l)
10.	Mercury (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	ND (LOD: 5 mg/l)
11.	Barium (mg/l)	US EPA 3052 Optical Emission Spectrometry by ICP-OES	19.0 (LOD: 5 mg/l)

Note: ND: Not Detected & LOD: Lower Detection Limit

It can be observed that lead, chromium, copper in the soil sample is 8.7 mg/l, 43.94 mg/l and 71.31 mg/l respectively and mercury and cadmium were observed to be not detected. Potassium in the soil sample was found to be 21621.0 mg/l.

4.12 Traffic Count

Traffic survey was undertaken at two roads near to the project site, details are presented in Figure 4-12 and Table 4-19, covering Wapda Road and Dhaka-Sylhet Highway. Wapda road is undivided 2-lane rural road with bidirectional traffic flow while Dhaka-Sylhet highway is four lanes divided road. The traffic count at both the roads was carried out for both the directions. These locations were selected based on the assumption that these will experience maximum vehicular movement during construction and operation phase of the project.

Figure 4-12: Traffic Monitoring Locations

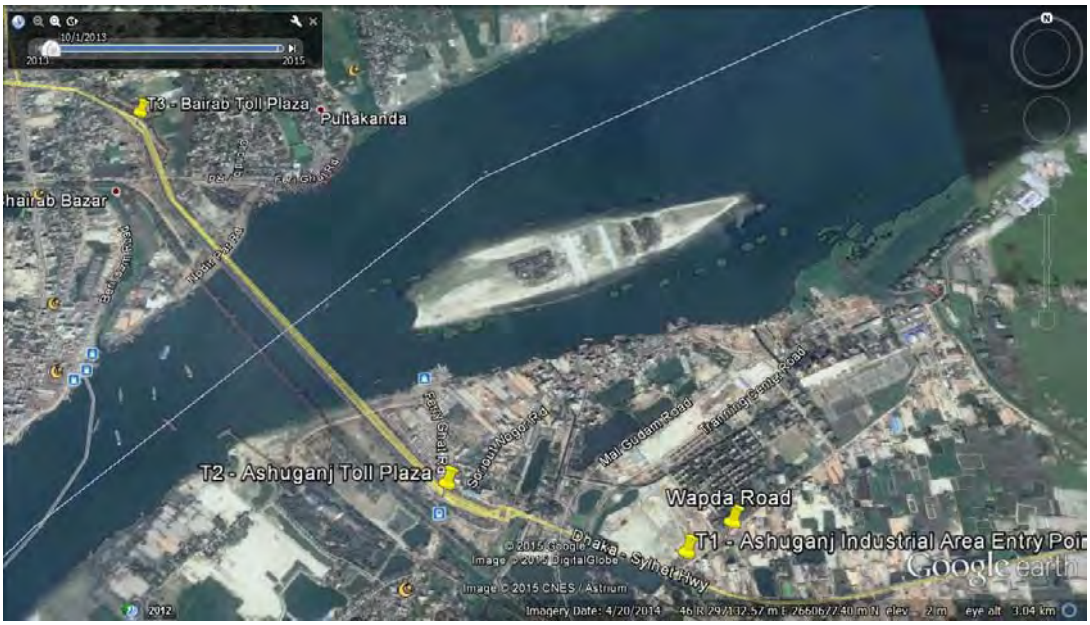


Table 4-19: Traffic Monitoring Locations

Location Code	Traffic Monitoring Location	Linked Road
T-1	Ashuganj Industrial Area Entry Point	Wapda Road
T-2	Ashuganj Toll Plaza	Dhaka-Sylhet Highway
T3	Bairab Toll Plaza	

The traffic count results indicate that out of the total traffic on Wapda Road (T1), non-motorised vehicles contribute to 45% followed by Heavy Commercial Vehicles (HCV) contributing 28% and Light Commercial Vehicles (LCV) contributing 17% (Table 4-20). Contribution of two wheelers and three wheelers to the total traffic on Wapda road is less than 10%, contributing 3% and 7% respectively.

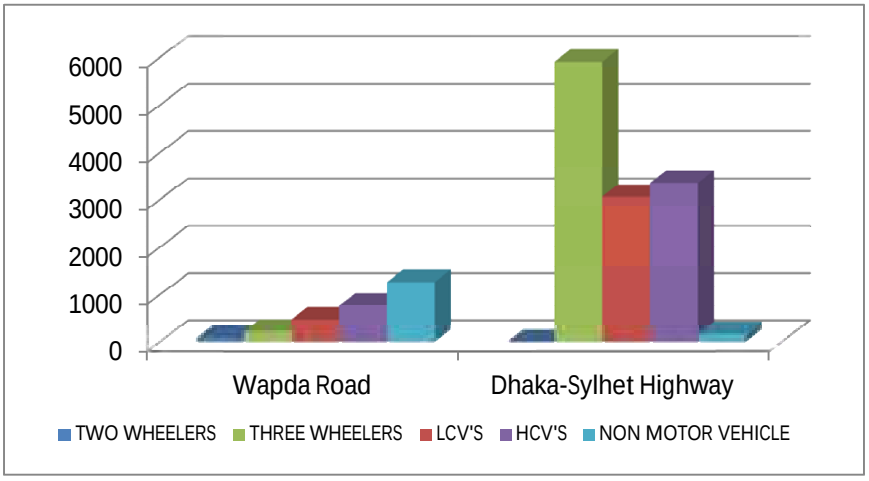
Maximum influx on Dhaka-Sylhet Highway is observed for three wheelers (47%) followed by HCV (27%) and LCV (25%). Non-motorised vehicles on highway contribute to 1.3% of the total traffic.

Table 4-20: Percentage Traffic Composition

Vehicle Type	Wapda Road		Dhaka-Sylhet Highway	
	Total No.	%	Total No.	%
Two Wheelers	79	2.8	0	0.0
Three wheelers	215	7.6	5916	47.3
LCV	472	16.8	3068	24.5
HCV	773	27.5	3364	26.9
Non motor vehicle	1277	45.3	168	1.3
Total	2816	100	12516	100

Source: Provided by UAEL, sourced from Ashuganj Toll Plaza and Bairab Toll Plaza

Figure 4-13: Traffic Count at Wapda Road and Dhaka-Shylet Highway



4.13 Biological Environment

4.13.1 Description of the Survey Area

The survey-area comprises a stretch of the floodplains of the upper Meghna River, one of the distributaries of the Ganga – Brahmaputra system. The topography of the survey-area is characterised by the stabilised deltaic depositions of the Meghna River.

Nearly every stable tract of land in the survey area is occupied by human settlements, with a range of attendant infrastructure such as embankments, jetties and roads. The riverine terraces and natural inland depressions are converted into paddy fields, many of which serve seasonally as aquaculture ponds. The higher reaches are largely under clusters of homesteads, surrounded by kitchen-gardens, orchards and plantations.

Fishing hamlets are situated close to the water's edge and usually serviced by separate makeshift bamboo jetties around which fishing craft are docked.

The eastern bank of the river is occupied by a vast industrial hub and is dominated by innumerable industrial installations, wide roads, embankments and jetties. The western bank is occupied by comparatively more residential areas.

The river channel is occupied, at all times, by the traffic of small and large cargo-boats, plying to and from the many jetties, as well as scores of motorized, oared or punted fishing craft and passenger ferries. There seems to be considerable sand-dredging activity in the river channel.

The aerial space of the survey area is interrupted mainly by power-cables and, especially on the eastern bank of the river, by a large number of industrial installations, accessory buildings, construction equipment like crane-gantries and cell-phone towers.

Natural vegetation in much of the survey-area is confined to a few patches of land relatively less accessed by humans and survives in the form of remnant individuals or groups of plants, dispersed in the overall human-altered space.

4.13.2 Literature Review

According to the Champion and Seth System of Classification, developed for forest-types of the Indian subcontinent, the natural vegetation of the survey-area may be classified into the following three types:

Type 4D/SS2 (Type SS1 – Barringtonia Swamp Forest, of Sub-group D - Tropical Seasonal Swamp Forests, of Group 4 – Littoral and Swamp Forests)

This forest-type is found in many areas of the Ganga-Brahmaputra alluvial plains. It is associated with tracts which are under water continuously for a fairly long period during the monsoon season. If the flooding is too deep and prolonged, tree-growth may be unable to establish itself, so that, until the level is raised by siltation, only grassland occurs. Between the flood-periods, the soil dries out to varying extents. Rainfall usually exceeds 1250 mm and the water-table never falls below 4-5 m.

Species that are characteristic of the forest type 4D/SS2 are listed in Table 4-21.

Table 4-21: Species characteristic of Forest Type 4D/SS2

Sr. No.	Scientific Name	Habit	Vernacular Name
1	*Barringtonia acutangula*	Tree	Ijol
2	*Syzigium cumini*	Tree	Jam
3	*Salix tetrasperma*	Tree	-
4	*Pongamia pinnata*	Tree	Hudo
5	*Streblus asper*	Tree	Havra
6	*Ficus glomerata*	Tree	-
7	*Ardisia solanacea*	Shrub	-
8	*Calamus tenuis*	Shrub	-

Source: H. G. Champion & S. K. Seth, 'A Revised Survey of the Forest Types of India'

Type 4D/2S2 (Type 2S2 – Eastern Wet Alluvial Grassland, of Sub-group D – Tropical Seasonal Swamp Forests, of Group 4 – Littoral and Swamp Forests)

This forest-type is essentially a grassland formation common in the Ganga-Brahmaputra alluvial plains. It is associated with cut-off meanders of rivers and other similar low alluvial sites. The grasses are upto 5 m high and very dense. It occurs in sites which are deeply flooded in monsoon, but the soil dries out completely in hot weather. This alternation is probably too severe for tree-growth and the grassland formation is likely to remain until slow siltation has raised the level considerably.

Species that are characteristic of the forest type 4D/2S2 are listed in Table 4-22.

Table 4-22: Species characteristic of Forest Type 4D/2S2

Sr. No.	Scientific Name	Habit	Vernacular Name
1	*Aristida spp.*	Grass	-
2	*Barringtonia acutangula*	Tree	Ijol
3	*Phragmites karka*	Grass	-
4	*Saccharum spontaneum*	Grass	Shon
5	*Themeda arundinacea*	Grass	-
6	*Vetiveria zizinoides*	Grass	-

Source: H. G. Champion & S. K. Seth, 'A Revised Survey of the Forest Types of India'

Type 5/1S2 (Primary Seral Type 1S2 – Khair-Sissu Forests, of Group 5 – Tropical Dry Deciduous Forests)

This type occurs along all the larger rivers of the northern part of the Indian sub-continent. They are typically associated with new sandy or gravelly alluvium. The influence of the soil far exceeds that of the climate, so that the same type can be found throughout the Indus-Ganga-Brahmaputra floodplains, from Punjab to Assam. There is ample water supply at a moderate depth, though the upper soil may be very porous, hot and dry during the summer, and almost devoid of humus. The soil is unstable and may be washed away at any time.

Species that are characteristic of the forest type 5/1S2 are listed in Table 4-23.

Table 4-23: Species characteristic of Forest Type 5/1S2

Sr. No.	Scientific Name	Habit	Vernacular Name
1	*Acacia catechu*	Tree	Khair
2	*Adhatoda vasica*	Shrub	-
3	*Albizzia procera*	Tree	Shil Kodoi
4	*Anthocephalus cadamba*	Tree	Kadam
5	*Bischofia javanica*	Tree	-
6	*Bombax ceiba*	Tree	Tula
7	*Calotropis procera*	Shrub	-
8	*Dalbergia sissoo*	Tree	Shissu
9	*Dillenia pentagyna*	Tree	Chalta
10	*Grewia oppositifolia*	Tree	-
11	*Haldina cordifolia*	Tree	Haldu
12	*Helicteres isora*	Shrub	-
13	*Holoptelea integrifolia*	Tree	-

Sr. No.	Scientific Name	Habit	Vernacular Name
14	*Kydia calycina*	Tree	-
15	*Lagerstroemia parviflora*	Tree	-
16	*Moringa oleifera*	Tree	Shojna
17	*Murraya koenigii*	Shrub	-
18	*Premna sp.*	Tree	-
19	*Tamarix dioica*	Shrub	-
20	*Tiliacora acuminata*	Tree	-
21	*Trema orientalis*	Tree	-
22	*Ziziphus mauritiana*	Tree	Boroi

Source: H. G. Champion & S. K. Seth, 'A Revised Survey of the Forest Types of India'

4.13.3 Information Sources

Individuals from whom secondary data was sourced include:

- Zahangir Alom, Principal Researcher, Bangladesh Cetacean Diversity Project, Khulna
- Brian D. Smith, Director, Asian Freshwater & Coastal Cetacean Program, Wildlife Conservation Society & Asia Coordinator, IUCN SSC Cetacean Specialist Group
- Md. Shahjahan, Forester, Bangladesh Forest Department, Brahmanbaria Sodor
- Asgar Ali, Assistant, Fisheries Section, Ashuganj Upazilla Parishad Office, Alom Nagar

Publications which were referred to for secondary data include:

- Champion H.G. and Seth S. K., A Revised Survey of the Forest Types of India
- Grimmett R., C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent
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- Brian D. Smith et al, Review of Conservation Status & Protected Areas for Ganges River Dolphin & Irrawaddy Dolphin in River Systems of Bangladesh (Workshop on Establishing Protected Areas for Asian Freshwater Cetaceans, 2009)
- Brian D. Smith et al, Profile of River Dolphins in Bangladesh with reference to Water Development (Environmental Management, Vol. 22, No. 3, 1998)

Websites which were referred to for secondary data include:

- www.iucn.org
- www.bnhsenvis.nic.in
- http://zsienvis.nic.in
- www.birdlife.org
- www.issg.org
- www.lntreasures.com/bangladesh.html
- www.worldwildlife.org/ecoregions
- www.birdlist.org/bangladesh.htm
- www.planbee.org.uk
- whc.unesco.org

4.13.4 Methodology

Primary Data

Nine accessible survey-sites were identified such that the various habitats and land-use types of the survey-area are adequately and proportionately covered by the survey.

At each site, floral diversity was recorded in terms of the species of trees, shrubs, climbers and herbs, both grasses and forbs, observed in course of a brief walk-over of the site.

At each site, faunal diversity was studied through both, direct evidence, in the form of visual sightings, and indirect evidence, such as calls, nests, burrows, droppings, scats, moults, tracks, etc. observed in course of a brief walk-over of the site, followed by visual scanning of the vicinity for approximately fifteen-minutes, specially to record avifauna.

In case of both, flora and fauna, only occurrence of a species at a given site was noted, without seeking to enumerate the individuals sighted. In view of time and resource constraints, and given the preliminary nature of this survey, the focus of the studies was limited to the higher flora, and amongst the fauna, to the higher and diurnal fauna.

Secondary Data

Additional information was sourced from available published literature, governmental institutions and local residents of the survey-area. The sources quoted are mentioned at the pertinent places in the report, besides being listed under Section 4.12.3 of this report.

Details of Sites Surveyed

The details of the nine sites within the survey-area at which primary data regarding flora and fauna was recorded are given in Table 4-24.

Table 4-24: Details of Sites Surveyed

S. No.	Location	Elevation (m)	Nearest Village(s)	Description of the Site
1	0296348 E, 2661542 N	12	Poltakanda	Orchard. Jetty. Embankment.
2	0297538 E, 2661021 N	9	Chor Shonarampur	Habitation.
3	0300371 E, 2660521 N	11	Bahadurpur	Marsh. Dirt track.
4	0294327 E, 2659427 N	12	Tulatuli, Chor Meghanabash	Plantation. Village commons.
5	0296995 E, 2658834 N	9	Shohagpur	Open scrub.
6	0294851 E, 2657615 N	8	Chor Chartola	Planted field. Pasture.
7	0297163 E, 2656821 N	12	Pream Tola, Nayabari	Pond. Plantation. Dirt track.
8	0294235 E, 2656635 N	7	Lalpur Chor	Planted field. Farm bund.
9	0293139 E, 2655771 N	4	Chandpur Chor	River bank.

4.13.5 Identified Modified Habitats

The survey-area contains the following modified habitats:

Farmlands

The lowlands of the survey-area largely comprise new riverine silt-depositions, while the highlands comprise the older stabilised terraces of the river's floodplains. Large parts of both have been cleared of natural vegetation and are being utilised by the local communities for cultivation. As part of prevalent farming practices, these lands have been levelled and are regularly ploughed and weeded, so that their natural drainage and vegetation stand almost permanently modified.

These farmlands support at least two seasonal crops through each year, usually a kharif (monsoon) rice crop followed by rabi (winter) pulses, besides a range of tubers and vegetables. The fields are protected from erosion by low farm-bunds, often planted over with fodder or thatch grasses.

Habitations

There are a number of small villages and hamlets distributed over the survey-area, especially on the western bank of the Meghna River. The close clusters of homesteads tend to be situated on the higher lands. They are surrounded by kitchen-gardens, plantations and orchards, and occasionally, small fields and aquaculture ponds.

The houses tend to be squat structures, mostly made of wattle-and-daub, brick-and-plaster or corrugated sheets of metal coated with black waterproofing material. They are roofed with thatch, earthen tiles or metal sheets. Livestock is penned close to houses, in open-sided, thatch-roofed shelters. The land around each house is usually plastered with a mixture of mud and animal-dung.

The more populous villages also possess larger storeyed buildings, made of stone or brick, which house government offices, educational institutions or places of worship. Many of them have large designated market areas.

Embankments

Embankments made of stone-and-earth or concrete have been built at many places in the survey-area to protect roads, jetties, farmlands or buildings from floodwaters. These embankments have modified the natural topography and drainage of the associated areas.

Roads

The survey-area is covered by a network of roads. The surfaces of the larger of these roads are covered with tar or paved with bricks, though smaller roads tend to be mere dirt-tracks or foot-trails.

Village Ponds and Dug Wells

Natural springs in the survey-area have been tapped through innumerable dug-wells, while tube-wells have been bored to access the groundwater. Rainwater collects in natural depressions or human-made hollows, to form small ponds that are accessed for domestic freshwater needs or used for aquaculture. Such ponds are more frequently seen around the older homesteads and settlements of the survey-area.

Jetties

Almost every village situated on the banks of the Meghna River is serviced by small, brick-and-cement or bamboo jetties where passenger ferries and fishing-boats can dock. The eastern bank, with its industrial area, is lined with larger concrete jetties, used for loading and unloading a variety of cargo, such as sand, bamboo-poles and bags of rice.

The bamboo jetties seem to interfere relatively less with the natural bank-vegetation, and are surrounded by a range of species associated with river-banks and marshes. As opposed to this, the concrete, embanked jetties are surrounded by nearly bare water.

4.13.6 Identified Natural Habitats

The survey-area contains natural habitats in the form of small remnant patches of natural vegetation or individual specimens of native species. While neither type of such habitats observed - swamp forests or grasslands – remains pristine, they do possess a fairly diverse floristic profile and seem to be supporting a considerable variety of wild fauna, including migratory avifauna.

Primary and secondary data collected during the survey indicates that the survey-area contains habitats of at least the following species of higher plants and animals.

Table 4-25 and Table 4-26 provide details of the woody and non-woody plants recorded in the survey-area.

Table 4-25: Details of Woody Plants

S. No.	Species	Habit	Vernacular Name
1	*Acacia auriculiformis*	Tree	Akashi
2	*Acacia mangium*	Tree	Mangium
3	*Aegle marmelos*	Tree	Bel
4	*Albizzia lebbeck*	Tree	Shiris
5	*Albizzia procera*	Tree	Shil Kodoi
6	*Alstonia scholaris*	Tree	-
7	*Annona reticulata*	Tree	Aatafal
8	*Anthocephalus cadamba*	Tree	Kadam
9	*Areca catechu*	Tree	-
10	*Artocarpus heterophyllus*	Tree	Kaathal
11	*Averrhoea bilimbi*	Tree	Bilumbi
12	*Averrhoea carambola*	Tree	Kamranga
13	*Azadirachta indica*	Tree	Desi Neem
14	*Barleria sp.*	Shrub	Mukta
15	*Barringtonia acutangula*	Tree	Ijol
16	*Bombax ceiba*	Tree	Tula
17	*Carica papaya*	Tree	Pepe
18	*Carissa congesta*	Shrub	Koromcha
19	*Cocos nucifera*	Tree	Narkel
20	*Crataeva magna*	Tree	Burum
21	*Croton bonplandianus*	Shrub	-
22	*Delonix regia*	Tree	Krishnachura
23	*Dendrocalamus strictus*	Bamboo	-
24	*Dillenia pentagyna*	Tree	Chalta
25	*Elaeocarpus floribundus*	Tree	Jolpayi
26	*Emblica officinalis*	Tree	Amlaki
27	*Erythrina variegata*	Tree	Mandar
28	*Eucalyptus sp.*	Tree	Yucliptas
29	*Ficus hispida*	Tree	Khuskhusi Pata
30	*Ficus religiosa*	Tree	Bhot
31	*Hibiscus rosa-sinensis*	Shrub	Jhoba Phool
32	*Ipomoea carnea*	Shrub	Komili
33	*Kirganellia reticulata*	Shrub	Sitka
34	*Lannea coromandelica*	Tree	Jigir
35	*Lantana camara*	Shrub	-
36	*Lantana indica*	Shrub	-
37	*Leucaena leucocephala*	Tree	-
38	*Mangifera indica*	Tree	Aam
39	*Melia azedarach*	Tree	Pahadi Neem/Bokain
40	*Moringa oleifera*	Tree	Shojna
41	*Morus alba*	Tree	-
42	*Phoenix sylvestris*	Tree	Khejur
43	*Pithecellobium dulce*	Tree	Jirabi
44	*Psidium guajava*	Tree	Piyara
45	*Quisqualis indica*	Climber	Madhobilata
46	*Samanea saman*	Tree	Brishti Ghaash
47	*Sida acuta*	Shrub	-
48	*Streblus asper*	Tree	Havra
49	*Swietenia mahogany*	Tree	Kat Mahogani
50	*Syzigium cumini*	Tree	Jam
51	*Syzigium jambos*	Tree	Jambura

S. No.	Species	Habit	Vernacular Name
52	*Tamarindus indica*	Tree	Tetul
53	*Terminalia arjuna*	Tree	Arjunsadada
54	*Terminalia catappa*	Tree	Kat Badam
55	*Trema orientalis*	Tree	-
6	*Trewia nudiflora*	Tree	Mehra
57	*Urena lobata*	Shrub	-
58	*Ziziphus mauritiana*	Tree	Boroi

Table 4-26: Details of Non-Woody Plants

S. No.	Species	Habit	Vernacular Name
1	*Alternanthera sp.*	Herb	-
2	*Amaranthus spinosus*	Herb	Kata Shak
3	*Amaranthus sp.*	Herb	Hechi Shak
4	*Ammania sp.*	Herb	-
5	*Bidens pilosa*	Herb	-
6	*Blumea sp.*	Herb	-
7	*Boerhavia diffusa*	Herb	-
8	*Cleome viscosa.*	Herb	-
9	*Coccinea indica*	Climber	-
10	*Colocasia esculenta*	Herb	Kosuila/Kochula
11	*Commelina benghalensis*	Herb	-
12	*Commelina sp.*	Herb	-
13	*Corchorus olitorius*	Herb	Pat Shak
14	*Cynodon dactylon*	Grass	Dubla
15	*Cyperus rotundus*	Herb	Mandur
16	*Cyperus sp.*	Herb	-
17	*Eichhornia crassipes*	Herb	Kochri Pana
18	*Eriocaulon sp.*	Herb	-
19	*Heliotropium indicum*	Herb	-
20	*Heliotropium sp.*	Herb	-
21	*Hydrilla verticillata*	Herb	-
22	*Hyptis suaveolens*	Herb	-
23	*Musa sapientum*	Herb	Kola
24	*Panicum sp.*	Grass	-
25	*Persicaria glabra*	Herb	-
26	*Saccharum spontaneum*	Grass	Shon
27	*Scoparia dulcis*	Herb	-
28	*Solanum nigrum*	Herb	-
29	*Solanum trilobatum*	Herb	-
30	*Spermacoce pusilla*	Herb	-
31	*Tridax procumbens*	Herb	-
32	*Vallisneria natans*	Herb	-
33	*Xanthium indicum*	Herb	Gagra

Table 4-27 to Table 4-31 provide details of the species of mammals, resident birds, reptiles, ambhibians and fishes, which have recorded ranges that include the survey-area.

Table 4-27: Details of Mammals

S. No.	Scientific Name	Common Name	IUCN Status**
1	*Macaca mulatta*	Rhesus Macaque	LC
2	*Semnopithecus entellus*	Hanuman Langur	LC

S. No.	Scientific Name	Common Name	IUCN Status**
3	*Sus scrofa*	Wild Pig	LC
4	*Canis aureus*	Jackal	LC
5	*Vulpes bengalensis*	Bengal Fox	LC
6	*Felis chaus*	Jungle Cat	LC
7	*Prionailurus bengalensis*	Leopard Cat	LC
8	*Prionailurus viverrinus*	Fishing Cat	E
9	*Lutrogale perspicillata*	Smooth-coated Otter	V
10	*Amblonyx cinereus*	Asian Small-clawed Otter	V
11	*Viverricula indica*	Small Indian Civet	NT
12	*Viverra zibetha*	Large Indian Civet	V
13	*Paradoxurus hermaphroditus*	Common Palm Civet	LC
14	*Herpestes edwardsii*	Grey Mongoose	LC
15	*Herpestes javanicus*	Small Asian Mongoose	LC
16	*Herpestes urva*	Crab-eating Mongoose	LC
17	*Manis crassicaudata*	Indian Pangolin	E
18	*Manis pentadactyla*	Chinese Pangolin	E
19	*Suncus murinus*	House Shrew	LC
20	*Suncus etruscus*	Pygmy Shrew	LC
21	*Crocidura attenuata*	Grey Woodland Shrew	LC
22	*Crocidura fulginosa*	Southeast Asian White-toothed Shrew	LC
23	*Hystrix brachyura*	Malayan Porcupine	LC
24	*Funambulus pennantii**	Five-striped Palm Squirrel	LC
25	*Bandicota indica*	Large Bandicoot-rat	LC
26	*Bandicota bengalensis*	Lesser Bandicoot-rat	LC
27	*Nesokia indica*	Short-tailed Bandicoot-rat	LC
28	*Rattus rattus*	House Rat	LC
29	*Rattus norvegicus*	Brown Rat	LC
30	*Millardia meltada*	Soft-furred Field Rat	LC
31	*Madromys blanfordi*	White-tailed Wood Rat	LC
32	*Vandeleuria oleracea*	Long-tailed Tree Mouse	LC
33	*Mus musculus*	House Mouse	LC
34	*Mus booduga*	Little Indian Field Mouse	LC
35	*Mus platythrix*	Brown Spiny Mouse	LC
36	*Mus terricolor*	Earth-colored Mouse	LC
37	*Tupaia belangiri*	Northern Tree Shrew	LC
38	*Pteropus giganteus*	Indian Flying Fox	LC
39	*Rousettus leschenaulti*	Leschenault's Rousette	LC
40	*Cynopterus brachyotis*	Lesser Dog-faced Fruit Bat	LC
41	*Cynopterus sphinx*	Short-nosed Fruit Bat	LC
42	*Rhinopoma hardwicki*	Lesser Mouse-tailed Bat	LC
43	*Taphozous longimanus*	Long-winged Tomb Bat	LC
44	*Rhinolophus rouxii*	Rufous Horseshoe Bat	LC
45	*Rhinolophus lepidus*	Blyth's Horseshoe Bat	LC
46	*Rhinolophus pusillus*	Least Horseshoe Bat	LC
47	*Rhinolophus trifoliatus*	Trefoil Horseshoe Bat	LC
48	*Hipposideros pomona*	Andersen's Leaf-nosed Bat	LC

S. No.	Scientific Name	Common Name	IUCN Status**
49	*Coelops frithii*	Tail-less Leaf-nosed Bat	LC
50	*Hipposideros lankadiva*	Kelaart's Leaf-nosed Bat	LC
51	*Megaderma lyra*	Greater False Vampire	LC
52	*Megaderma spasma*	Lesser False Vampire	LC
53	*Kerivoula hardwickii*	Hardwicke's Forest Bat	LC
54	*Myotis formosus*	Hodgson's Bat	LC
55	*Myotis annectans*	Hairy-faced Bat	LC
56	*Myotis mystacinus*	Whiskered Bat	LC
57	*Scotophilus heathii*	Asiatic Greater Yellow House Bat	LC
58	*Murina leucogaster*	Greater Tube-nosed Bat	LC
59	*Harpiocephalus harpia*	Hairy-winged Bat	LC
60	*Pipistrellus coromandra*	Coromandel Pipistrelle	LC
61	*Pipistrellus tenuis*	Least Pipistrelle	LC
62	*Pipistrellus paterculus*	Mount Popa Pipistrelle	LC
63	*Pipistrellus kuhlii*	Kuhl's Pipistrelle	LC
64	*Scotozous dormeri*	Dormer's Bat	LC
65	*Miniopterus schreibersii*	Schreiber's Long-fingered Bat	LC
66	*Scotoecus pallidus*	Yellow Desert Bat	LC
67	*Hesperoptenus tickelli*	Tickell's Bat	LC
68	*Platanista gangetica*	Ganges River Dolphin	E

* Sighted personally by the survey-team during the survey

** E – Endangered, LC – Least Concern, NT – Near Threatened and V – Vulnerable

Sources: S. H. Prater, Book of Indian Animals; Vivek Menon, A Field Guide to Indian Mammals (2003), www.iucnredlist.org (2013

Table 4-28: Details of Birds

S. No.	Scientific Name	Common Name	IUCN Status**
1	*Francolinus francolinus*	Black Francolin	LC
2	*Gallus gallus*	Red Junglefowl	LC
3	*Pavo cristatus*	Indian Peafowl	LC
4	*Dendrocygna javanica**	Lesser Whistling Duck	LC
5	*Sarkidiornis melanotos*	Knob-billed Duck	LC
6	*Nettapus coromandelianus*	Cotton Pygmy Goose	LC
7	*Anas poecilorhyncha*	Indian Spot-billed Duck	LC
8	*Rhodonessa caryophyllacea*	Pink-headed Duck	CR
9	*Tachybaptus ruficollis*	Little Grebe	LC
10	*Anastomus oscitans*	Asian Openbill	LC
11	*Leptoptilos javanicus*	Lesser Adjutant	V
12	*Leptoptilos dubius*	Greater Adjutant	E
13	*Threskiornis melanocephalus*	Black-headed Ibis	NT
14	*Pseudibis papillosa*	Red-naped Ibis	LC
15	*Plegadis falcinellus*	Glossy Ibis	LC
16	*Ixobrychus sinensis*	Yellow Bittern	LC
17	*Ixobrychus cinnamomeus*	Cinnamon Bittern	LC
18	*Butorides striata*	Striated Heron	LC

S. No.	Scientific Name	Common Name	IUCN Status**
19	*Nycticorax nycticorax*	Black-crowned Night Heron	LC
20	*Ardeola grayii**	Indian Pond Heron	LC
21	*Ardea cinerea*	Grey Heron	LC
22	*Ardea goliath*	Goliath Heron	LC
23	*Bubulcus ibis**	Cattle Egret	LC
24	*Casmerodius albus*	Great Egret	LC
25	*Mesophoyx intermedia**	Intermediate Egret	LC
26	*Egretta garzetta**	Little Egret	LC
27	*Anhinga melanogaster*	Darter	NT
28	*Phalacrocorax niger**	Little Cormorant	LC
29	*Phalacrocorax fuscicollis**	Indian Cormorant	LC
30	*Falco chicquera*	Red-necked Falcon	NT
31	*Falco jugger*	Laggar Falcon	NT
32	*Elanus caeruleus*	Black-winged Kite	LC
33	*Milvus migrans**	Black Kite	LC
34	*Haliastur indus**	Brahminy Kite	LC
35	*Haliaeetus leucogaster*	White-bellied Sea Eagle	LC
36	*Haliaeetus leucoryphus*	Pallas's Fish Eagle	V
37	*Ichthyophaga ichthyaetus*	Grey-headed Fish Eagle	NT
38	*Ictinaetus malayensis*	Black Eagle	LC
39	*Pernis ptilorhynchus*	Oriental Honey Buzzard	LC
40	*Gyps bengalensis*	White-rumped Vulture	CR
41	*Circaetus gallicus*	Short-toed Snake Eagle	LC
42	*Spilornis cheela*	Crested Serpent Eagle	LC
43	*Accipiter badius*	Shikra	LC
44	*Accipiter virgatus*	Besra	LC
45	*Accipiter gentilis*	Northern Goshawk	LC
46	*Aquila hastata*	Indian Spotted Eagle	V
47	*Nisaetus limnaeetus*	Changeable Hawk Eagle	LC
48	*Houbaropsis bengalensis*	Bengal Florican	CR
49	*Amaurornis phoenicurus*	White-breasted Waterhen	LC
50	*Gallicrex cinerea*	Watercock	LC
51	*Turnix suscitator*	Barred Buttonquail	LC
52	*Porphyrio porphyrio*	Purple Swamphen	LC
53	*Gallinula chloropus*	Common Moorhen	LC
54	*Fulica atra*	Eurasian Coot	LC
55	*Grus antigone*	Sarus Crane	V
56	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	LC
57	*Metopidius indicus*	Bronze-winged Jacana	LC
58	*Vanellus duvaucelii*	River Lapwing	LC
59	*Vanellus indicus**	Red-wattled Lapwing	LC
60	*Charadrius dubius*	Little Ringed Plover	LC
61	*Rostratula benghalensis*	Greater Painted Snipe	LC
62	*Glareola maldivarum*	Oriental Pratincole	LC
63	*Glareola lactea*	Small Pratincole	LC
64	*Sterna aurantia**	River Tern	LC

S. No.	Scientific Name	Common Name	IUCN Status**
65	*Sternula albifrons*	Little Tern	LC
66	*Columba livia**	Common Pigeon	LC
67	*Streptopelia orientalis**	Oriental Turtle Dove	LC
68	*Streptopelia decaocto**	Eurasian Collared Dove	LC
69	*Streptopelia tranquebarica*	Red Collared Dove	LC
70	*Stigmatopelia chinensis**	Spotted Dove	LC
71	*Treron bicinctus*	Orange-breasted Green Pigeon	LC
72	*Treron phoenicopterus*	Yellow-footed Green Pigeon	LC
73	*Treron sphenurus*	Wedge-tailed Green Pigeon	LC
74	*Chalcophaps indica*	Emerald Dove	LC
75	*Psittacula krameri**	Rose-ringed Parakeet	LC
76	*Psittacula roseata*	Blossom-headed Parakeet	LC
77	*Hierococcyx varius*	Common Hawk Cuckoo	LC
78	*Cuculus micropterus*	Indian Cuckoo	LC
79	*Cacomantis merulinus*	Plaintive Cuckoo	LC
80	*Eudynamis scolopaceus**	Asian Koel	LC
81	*Centropus sinensis*	Greater Coucal	LC
82	*Centropus bengalensis*	Lesser Coucal	LC
83	*Tyto alba*	Barn Owl	LC
84	*Otus lettia*	Collared Scops Owl	LC
85	*Otus sunia*	Oriental Scops Owl	LC
86	*Athene brama*	Spotted Owlet	LC
87	*Ninox scutulata*	Brown Hawk Owl	LC
88	*Caprimulgus macrurus*	Large-tailed Nightjar	LC
89	*Cypsiurus balasiensis**	Asian Palm Swift	LC
90	*Apus nipalensis*	House Swift	LC
91	*Upupa epops*	Common Hoopoe	LC
92	*Coracias benghalensis*	Indian Roller	LC
93	*Pelargopsis capensis*	Stork-billed Kingfisher	LC
94	*Halcyon smyrnensis**	White-throated Kingfisher	LC
95	*Halcyon pileata*	Black-capped Kingfisher	LC
96	*Alcedo atthis*	Common Kingfisher	LC
97	*Ceryle rudis*	Pied Kingfisher	LC
98	*Merops orientalis**	Green Bee-eater	LC
99	*Megalaima asiatica*	Blue-throated Barbet	LC
100	*Megalaima haemacephala**	Coppersmith Barbet	LC
101	*Micropternus brachyurus*	Rufous Woodpecker	LC
102	*Dendrocopos macei*	Fulvous-breasted Woodpecker	LC
103	*Dinopium benghalense*	Lesser Goldenback	LC
104	*Artamus fuscus*	Ashy Woodswallow	LC
105	*Aegithina tiphia*	Common Iora	LC
106	*Pericrocotus cinnamomeus*	Small Minivet	LC
107	*Lanius vittatus*	Bay-backed Shrike	LC
108	*Lanius schach*	Long-tailed Shrike	LC

S. No.	Scientific Name	Common Name	IUCN Status**
109	*Lanius meridionalis*	Southern Grey Shrike	LC
110	*Dicrurus macrocercus**	Black Drongo	LC
111	*Oriolus kundoo*	Indian Golden Oriole	LC
112	*Oriolus xanthornus*	Black-hooded Oriole	LC
113	*Rhipidura albicollis*	White-throated Fantail	LC
114	*Hypothymis azurea*	Black-naped Monarch	LC
115	*Dendrocitta vagabunda*	Rufous Treepie	LC
116	*Corvus levaillantii**	Eastern Jungle Crow	LC
117	*Corvus splendens**	House Crow	LC
118	*Parus major*	Great Tit	LC
119	*Riparia paludicola*	Plain Martin	LC
120	*Mirafra assamica*	Bengal Bushlark	LC
121	*Calandrella raytal*	Sand Lark	LC
122	*Eremopterix griseus*	Ashy-crowned Sparrow Lark	LC
123	*Alauda gulgula*	Oriental Skylark	LC
124	*Pycnonotus atriceps*	Black-headed Bulbul	LC
125	*Pycnonotus flaviventris*	Black-crested Bulbul	LC
126	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC
127	*Pycnonotus cafer**	Red-vented Bulbul	LC
128	*Hypsipetes leucocephalus*	Black Bulbul	LC
129	*Prinia inornata**	Plain Prinia	LC
130	*Cisticola juncidis*	Zitting Cisticola	LC
131	*Orthotomus sutorius**	Common Tailorbird	LC
132	*Megalurus palustris*	Striated Grassbird	LC
133	*Turdoides earlei*	Striated Babbler	LC
134	*Turdoides striata**	Jungle Babbler	LC
135	*Garrulax ruficollis*	Rufous-necked Laughingthrush	LC
136	*Zosterops palpebrosus*	Oriental White-eye	LC
137	*Acridotheres fuscus*	Jungle Myna	LC
138	*Acridotheres tristis**	Common Myna	LC
139	*Gracupica contra**	Asian Pied Starling	LC
140	*Sturnia malabarica*	Chestnut-tailed Starling	LC
141	*Sturnia pagodarum*	Brahminy Starling	LC
142	*Zoothera citrina*	Orange-headed Thrush	LC
143	*Turdus unicolor*	Tickell's Thrush	LC
144	*Copsychus saularis**	Oriental Magpie Robin	LC
145	*Copsychus malabaricus*	White-rumped Shama	LC
146	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	LC
147	*Leptocoma zeylonica*	Purple-rumped Sunbird	LC
148	*Cinnyris asiaticus**	Purple Sunbird	LC
149	*Passer domesticus**	House Sparrow	LC
150	*Ploceus benghalensis*	Black-breasted Weaver	LC
151	*Ploceus philippinus**	Baya Weaver	LC
152	*Euodice malabarica*	Indian Silverbill	LC
153	*Amandava amandava*	Red Avadavat	LC

S. No.	Scientific Name	Common Name	IUCN Status**
154	*Lonchura punctulata**	Scaly-breasted Munia	LC
155	*Lonchura atricapilla*	Chestnut Munia	LC
156	*Motacilla maderaspatensis**	White-browed Wagtail	LC
157	*Anthus rufulus*	Paddyfield Pipit	LC

* Sighted personally by the survey-team during the survey
** CR – Critically Endangered, E – Endangered, LC – Least Concern, NT – Near Threatened and V - Vulnerable
Sources: R. Grimmett, C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent (2011), www.iucnredlist.org (2013)

Table 4-29: Details of Reptiles

S. No.	Scientific Name	Common Name	IUCN Status**
1	*Ramphotyphlops braminus*	Brahminy Blind Snake	NA
2	*Typhlops diardii*	Indochinese Blind Snake	LC
3	*Grypotyphlops acutus*	Beaked Blind Snake	LC
4	*Python molurus molurus*	Asiatic Rock Python	-
5	*Python molurus bivittatus*	Burmese Python	V
6	*Gongylophis conicus*	Common Sand Boa	NA
7	*Eryx johnii*	Red Sand Boa	LC
8	*Coelognathus radiatus*	Copper-headed Trinket Snake	NA
9	*Coelognathus helena*	Indian Trinket Snake	NA
10	*Ptyas mucosa*	Indian Rat Snake	NA
11	*Argyrogena fasciolata*	Banded Racer	NA
12	*Oligodon albocinctus*	White-barred Kukri Snake	NA
13	*Oligodon taeniolatus*	Streaked Kuktri Snake	LC
14	*Oligodon arnensis*	Banded Kukri Snake	NA
15	*Dendralaphis pictus*	Painted Bronzeback Tree Snake	NA
16	*Dendralaphis tristis*	Common Bronzeback Tree Snake	NA
17	*Chrysopelea ornata*	-	NA
18	*Lycodon jara*	Yellow-speckled Wolf Snake	LC
19	*Lycodon aulicus*	Common Wolf Snake	NA
20	*Sibynophis subpunctatus*	-	NA
21	*Xenochrophis piscator*	Checkered Keelback Water Snake	NA
22	*Amphiesma stolatum*	Buff-striped Keelback	NA
23	*Macropisthodon plumbicolor*	-	NA
24	*Atretium schistosum*	Olive Keelback Water Snake	LC
25	*Boiga trigonata*	Common Indian Cat Snake	LC
26	*Psammodynastes pulverulentus*	-	NA
27	*Ahaetulla nasuta*	Common Vine Snake	NA
28	*Enhydris enhydris*	Striped Water Snake	LC
29	*Enhydris sieboldii*	Siebold's Smooth Water Snake	LC
30	*Atretium schistosum*	Olive Keelback Water Snake	LC
31	*Bungarus fasciatus*	Banded Krait	LC
32	*Bungarus caeruleus*	Indian Krait	NA
33	*Calliophis melanurus*	Black-tailed Coral Snake	NA
34	*Sinomicrurus macclellandi*	-	NA
35	*Naja naja*	Spectacled Cobra	-

S. No.	Scientific Name	Common Name	IUCN Status**
36	*Naja kaouthia*	Monocled Cobra	LC
37	*Ophiophagus hannah*	King Cobra	V
38	*Daboia russelii*	Russell's Viper	LC
39	*Ovophis monticola*	Chinese Mountain Pit Viper	LC
40	*Calotes versicolor**	Indian Garden Lizard	NA
41	*Draco blanfordi*	Blanford's Flying Lizard	NA
42	*Cosymbotus platyurus*	Flat-tailed Gecko	NA
43	*Gekko gecko*	Tokay Gecko	NA
44	*Hemidactylus bowringii*	Bowring's Gecko	NA
45	*Hemidactylus flaviviridis*	Yellow-green House Gecko	NA
46	*Hemidactylus frenatus*	Asian House Gecko	NA
47	*Hemidactylus leschenaultii*	Bark Gecko	NA
48	*Takydromus khasiensis*	Khasi Hills Long-tailed Lizard	NA
49	*Lygosoma punctata*	Spotted Supple Skink	LC
50	*Mabuya macularia*	Bronze Grass Skink	NA
51	*Varanus bengalensis*	Bengal Monitor	LC
52	*Varanus flavescens*	Yellow Monitor	LC
53	*Varanus salvator*	Water Monitor	LC
54	*Crocodylus paluster*	Mugger Crocodile	NA
55	*Gavialus gangeticus*	Gharial	NA
56	*Batagur baska*	Four-toed River Terrapin	CR
57	*Cuora amboinensis*	Southeast Asian Box Turtle	V
58	*Cyclemis oldhami*	Oldham's Leaf Turtle	NA
59	*Geoclemys hamiltonii*	Black-spotted Turtle	V
60	*Hardella thurjii*	Crowned River Turtle	V
61	*Batagur dhongoka*	Three-striped Roofed Turtle	E
62	*Melanochelys trijuga*	Indian Black Turtle	NT
63	*Morenia petersi*	Indian Eyed Turtle	V
64	*Pangshura smithii*	Brown Roofed Turtle	NT
65	*Pangshura sylhetensis*	Assam Roofed Turtle	E
66	*Pangshura tectum*	Indian Roofed Turtle	NA
67	*Pangshura tentoria*	Indian Tent Turtle	LC
68	*Indotestudo elongata*	Yellow-headed Tortoise	E
69	*Nilssonia gangeticum*	Indian Softshell Turtle	V
70	*Nilssonia hurum*	Indian Peacock Softshell Turtle	V
71	*Chitra indica*	Indian Narrow-headed Softshell Turtle	E
72	*Lissemys punctata*	Indian Flapshell Turtle	LC

* Sighted personally by the survey-team during the survey;** CR – Critically Endangered, E – Endangered, LC – Least Concern, NA – Not Assessed, NT – Near Threatened and V – Vulnerable

Sources: Indraneil Das, Snakes and other Reptiles of India (2002); Romulus Whitaker & Ashok Captain, Snakes of India (2006); www.iucnredlist.org (2013)

Table 4-30: Details of Amphibians

S. No.	Scientific Name	Common Name	IUCN Status**
1	*Duttaphrynus melanostictus*	Black-spectacled Toad	LC
2	*Rhacophorus maculatus*	-	NA
3	*Rana cyanophlyctia*	Skipper Frog	NA

4	*Fejervarya asmati*	Bangladesh Cricket Frog	NA
5	*Fejervarya limnocharis*	Asian Grass Frog	LC
6	*Hoplobatrachus litoralis*	-	NA
7	*Hoplobatrachus rugulosus**	East Asian Bullfrog	LC
8	*Rana hexadactyla*	-	NA
9	*Hylarana temporalis*	-	NT
10	*Microhyla ornata*	Ornamented Pygmy Frog	LC

* Sighted personally by the survey-team during the survey; ** LC – Least Concern, NA – Not Assessed and NT – Near Threatened

Sources: United Nations Development Programme & Food and Agricultural Organisation; Integrated Development of the Sundarbans Reserved Forest, Bangladesh (1998)

Table 4-31: Details of Fishes

S. No.	Scientific Name	Common Name	IUCN Status**
1	*Ailia coila*	Gangetic Ailia/Bashpata	NT
2	*Amblypharyngodon mola*	Mola	LC
3	*Anabas testudineus*	Climbing Perch/Koi	DD
4	*Anguilla bengalensis*	Indian Long-fin Eel	LC
5	*Aorichthys seenghala*	Giant River Catfish	NA
6	*Aplocheilus panchax*	Blue Panchax/Kanpona	LC
7	*Badis badis*	Meni	LC
8	*Botia lohachata*	Y-Loach	NA
9	*Brachydanio rerio*	Zebra Danio	NA
10	*Catla catla*	Catla	NA
11	*Chanda ranga*	Glassy Perchlet/Chanda	LC
12	*Channa marulius*	Giant Snakehead/Gozar	LC
13	*Channa orientalis*	Dwarf Snakehead	NA
14	*Channa punctatus*	Spotted Snakehead/Taki	NA
15	*Channa striatus*	Striped Snakehead/Shol	NA
16	*Chela cachius*	Silver Hatchet Chela/Chela	LC
17	*Chela laubuca*	Indian Glass Barb	NA
18	*Chitala chitala*	Chital	NT
19	*Cirrhinus mrigala*	Mrigal	NA
20	*Cirrhinus reba*	Reba Carp	LC
21	*Clarias batrachus*	Magur	LC
22	*Colisa fasciatus*	Kholisha	NA
23	*Conica suborna*	Kachki	-
24	*Devario malabaricus*	Giant Danio	LC
25	*Esomus danricus*	Flying Barb	LC
26	*Eutropiichthys vacha*	Batchwa Vacha	LC
27	*Glossogobius giurus*	Goby/Baila	NA
28	*Gonialosa manmina*	Ganges River Gizzard Shad	LC
29	*Gudusia chapra*	Indian River Shad/Chapila	LC
30	*Heteropneustes fossilis*	Stinging Catfish/Shing	LC
31	*Hilsa ilisha*	Hilsa/Ilish	NA
32	*Hilsa kelee*	Kelee Shad	NA
33	*Hilsa toli*	Toli Shad	NA

S. No.	Scientific Name	Common Name	IUCN Status**
34	*Labeo angra*	Angra Labeo	LC
35	*Labeo calbasu*	Black Rohu/Kalibaush	LC
36	*Labeo rohita*	Rohu/Rui	LC
37	*Liza persia*	Goldspot Mullet/Bata	NA
38	*Macrobrachium equidense*	Chingri	-
39	*Mastacembelus armatus*	Marbled Spiny Eel/Bain	LC
40	*Mastacembelus gulio*	Gulsha	-
41	*Mystus cavasius*	Gangetic Mystus/Golsha	LC
42	*Mystus gulio*	Long-whiskered Catfish	LC
43	*Mystus vittatus*	Striped Dwarf Catfish/Tengra	LC
44	*Nandus nandus*	Mottled Nandus/Raina	LC
45	*Nemacheilus denisoni*	Day's Loach	LC
46	*Nematalosa nasus*	Bloch's Gizzard Shad	LC
47	*Neolissochilus hexagonolepis*	Katli	NT
48	*Neotropinus atherinoides*	Batashi	-
49	*Notopterus notopterus*	Fali	LC
50	*Ompok bimaculatus*	Indian Butter Catfish	NT
51	*Ompok pabda*	Pabdah Butterfish/Pabda	NT
52	*Oreochromis mossambica*	Tilapia	NA
53	*Oryzias melastigma*	Estuarine Ricefish	LC
54	*Osphronemus goramy*	Giant Gourami	LC
55	*Otolithoides pama*	Poa	NA
56	*Pangasius pangasius*	Fatty Catfish	LC
57	*Parluciosoma daniconius*	Blackline Rasbora	LC
58	*Pseudambassis ranga*	Indian Glassy Fish	LC
59	*Pungasius pungasius*	Pungas	NA
60	*Puntius conchonius*	Red Barb/Puti	LC
61	*Puntius sarana*	Olive Barb/Raj Punti	LC
62	*Puntius sophore*	Spotfin Swamp Barb	LC
63	*Puntius ticto*	Ticto Barb	LC
64	*Rita rita*	Rita	LC
65	*Salmostoma phulo*	Chela	NA
66	*Schistura scaturigina*	Dari	LC
67	*Setipinna phasa*	Gangetic Hairfin Anchovy/Fasha	LC
68	*Silonia silondia*	Silong Catfish/Shilon	LC
69	*Sperata aor*	Long-whiskered Catfish/Ayre	LC
70	*Tilapia nilotica*	Tilapia	LC
71	*Tor tor*	Tor Mahseer	NT
72	*Wallago attu*	Boal	NT
73	*Xenontodon cancila*	Kakila	-

* DD – Data Deficient, LC – Least Concern, NA – Not Assessed and NT – Near Threatened

Sources: R. J. Ranjit Daniels, Freshwater Fishes of Peninsular India (2002); B. F. Chhapgar, Common Fishes of India (1988); Md. Muazzem Hossain, Land-zoning Report for Ashuganj Upazilla, Ministry of Land, Government of Bangladesh (2011); www.iucnredlist.org (2013)

4.13.7 Invasive Alien / Non-native Species

The following invasive alien/non-native species of higher plants or animals have either been recorded in the survey-area or are reported from the region in which the survey-area is located. Table 4-32 gives the details of such floristic species, while Table 4-33 gives the details of such faunal species, comprising birds and fishes.

Table 4-32: Details of Invasive Alien Floristic Species

S. No.	Scientific Name	Habit	Vernacular Name
1	*Cyperus rotundus*	Herb	Mandur
2	*Eichhornia crassipes*	Herb	Kochri Pana
3	*Ipomoea carnea*	Shrub	Komili
4	*Lantana camara*	Shrub	-
5	*Leucaena latisiliqua*	Tree	-
6	*Panicum sp.*	Grass	-

Table 4-33: Details of Invasive Alien Faunal Species

S. No.	Scientific Name	Common Name	Vernacular Name
Birds			
1	*Columba livia*	Common Pigeon	Kobutar
Fishes			
1	*Clarias gariepinus*	African Catfish	-
2	*Gambusia affinis*	Mosquito Fish	Guppy
3	*Pangasius sutchi*	Tiger Shark	Pungas
4	*Tilapia nilotica*	Tilapia	Tilapia
5	*Oreochromis mossambica*	Tilapia	Tilapia

Sources: www.issg.org; Md. Nurul Amin, Md. Yusuf Ali & Md. Salequzzaman, Identification & Impact Analysis of Invasive Species: A Case Study in the Mongla Sea Port Area of Bagerhat District of Bangladesh (Daffodil International University Journal of Science & Technology, Vol. 4, No. 1, 2009)

4.13.8 Identified Critical Habitats

The survey-area is likely to be containing habitats that are of significant importance to many species of special conservation-value.

Critically Endangered / Endangered Species

The following species of higher animals, designated by the IUCN as being 'Critically Endangered' or 'Endangered', have recorded ranges that include the survey-area.Table 4-34 to Table 4-36 list such species of mammals, birds and reptiles, respectively.

Table 4-34: Details of Endangered Mammals

S. No.	Scientific Name	Common Name	IUCN Status*
1	*Prionailurus viverrinus*	Fishing Cat	E
2	*Manis crassicaudata*	Indian Pangolin	E
3	*Manis pentadactyla*	Chinese Pangolin	E
4	*Platanista gangetica*	Ganges River Dolphin	E

* E – Endangered; Sources: S. H. Prater, Book of Indian Animals; Vivek Menon, A Field Guide to Indian Mammals (2003); www.iucnredlist.org (2013)

Table 4-35: Details of Critically Endangered or Endangered Birds

S. No.	Scientific Name	Common Name	IUCN Status*
1	*Aythya baeri*	Baer's Pochard	CR
2	*Rhodonessa caryophyllacea*	Pink-headed Duck	CR
3	*Leptoptilos dubius*	Greater Adjutant	E
4	*Gyps bengalensis*	White-rumped Vulture	CR
5	*Houbaropsis bengalensis*	Bengal Florican	CR

* CR – Critically Endangered and E - Endangered
Source: R. Grimmett, C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent (2011); www.iucnredlist.org (2013)

Table 4-36: Details of Critically Endangered or Endangered Reptiles

S. No.	Scientific Name	Common Name	IUCN Status*
1	*Batagur baska*	Four-toed River Terrapin	CR
2	*Batagur dhongoka*	Three-striped Roofed Turtle	E
3	*Pangshura sylhetensis*	Assam Roofed Turtle	E
4	*Indotestudo elongate*	Yellow-headed Tortoise	E
5	*Chitra indica*	Indian Narrow-headed Softshell Turtle	E

* CR – Critically Endangered and E – Endangered
Sources: Indraneil Das, Snakes and other Reptiles of India (2002); Romulus Whitaker & Ashok Captain, Snakes of India (2006); www.iucnredlist.org (2013)

Endemic and/or Restricted Range Species

The higher animals which are endemic to, or have restricted ranges that include, some part of the region in which the survey-area is located are listed in Table 4-37 to Table 4-41, respectively.

Table 4-37: Details of Endemic or Restricted Range Mammals

S. No.	Scientific Name	Common Name	Range
1	*Herpestes urva*	Crab-eating Mongoose	West Bengal, Northeast India, Bangladesh
2	*Platanista gangetica*	Ganges River Dolphin	Ganga & Brahmaputra river-systems

Sources: S. H. Prater, Book of Indian Animals; Vivek Menon, A Field Guide to Indian Mammals (2003)

Table 4-38: Details of Endemic or Restricted Range Birds

S. No.	Scientific Name	Common Name	Range
1	*Rhodonessa caryophyllacea*	Pink-headed Duck	Eastern & Northeastern India, Bangladesh
2	*Cacomantis merulinus*	Plaintive Cuckoo	Northeastern India, Bangladesh
3	*Apus nipalensis*	House Swift	Himalayas, Northeastern India, Bangladesh
4	*Megalaima asiatica*	Blue-throated Barbet	Himalayas, Northeastern India, Bangladesh

Source: R. Grimmett, C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent (2011)

Table 4-39: Details of Endemic or Restricted Range Reptiles

S. No.	Scientific Name	Common Name	Range
1	*Typhlops diardii*	Indochinese Blind Snake	Himalayas, Bangladesh, Myanmar
2	*Oligodon albocinctus*	White-barred Kukri Snake	Nepal, Northeast India, Bangladesh, Myanmar
3	*Batagur baska*	River Terrapin	Coasts along Northern and Eastern Bay of Bengal

Sources: Indraneil Das, Snakes and other Reptiles of India (2002); Romulus Whitaker & Ashok Captain, Snakes of India (2006)

Table 4-40: Details of Endemic or Restricted Range Amphibians

Sr. No.	Scientific Name	Common Name	Range
1	*Fejervarya asmati*	Bangladesh Cricket Frog	Chittagong & Dhaka regions

Sources: United Nations Development Programme & Food and Agricultural Organisation, Integrated Development of the Sundarbans Reserved Forest, Bangladesh (1998); www.issg.org

Table 4-41: Details of Endemic or Restricted Range Fishes

Sr. No.	Scientific Name	Common Name	Range
1	*Nangra bucculenta*	-	Central Bangladesh
2	*Nangra ornate*	-	Drainage of Meghna River
3	*Psilorhynchus gracilis*	Rainbow Minnow	Bangladesh

Sources: www.Intreasures.com/bangladesh.html; www.issg.org

Migratory Species

The survey area is located within the Brahmaputra river-system, believed to be the chief avian migratory flyway for birds entering the Indian subcontinent from northeast Asia. Thus, the survey-area is very likely to fall in the flight-path of the various winter, summer and passage visitor-birds migrating to/ through the region in which it is situated. All such avian species recorded are listed in Table 4-42.

Table 4-42: Details of Migratory Avian Species

Sr. No.	Scientific Name	Common Name	Type	IUCN Status
1	*Dendrocygna bicolor*	Fulvous Whistling Duck	Winter	LC
2	*Anser anser*	Greylag Goose	Winter	LC
3	*Anser indicus*	Bar-headed Goose	Winter	LC
4	*Tadorna tadorna*	Common Shelduck	Winter	LC
5	*Tadorna ferruginea*	Ruddy Shelduck	Winter	LC
6	*Anas strepera*	Gadwall	Winter	LC
7	*Anas falcata*	Falcated Duck	Winter	NT
8	*Anas penelope*	Eurasian Wigeon	Winter	LC
9	*Anas platyrhynchos*	Mallard	Winter	LC
10	*Anas clypeata*	Northern Shoveler	Winter	LC
11	*Anas acuta*	Northern Pintail	Winter	LC
12	*Anas querquedula*	Garganey	Winter	LC
13	*Anas formosa*	Baikal Teal	Winter	LC
14	*Anas crecca*	Common Teal	Winter	LC
15	*Aythya farina*	Common Pochard	Winter	LC
16	*Aythya baeri*	Baer's Pochard	Winter	CR
17	*Aythya nyroca*	Ferruginous Duck	Winter	NT
18	*Aythya fuligula*	Tufted Duck	Winter	LC
19	*Podiceps grisegena*	Red-necked Grebe	Winter	LC
20	*Podiceps cristatus*	Great Crested Grebe	Winter	LC
21	*Mycteria leucocephala*	Painted Stork	Winter	NT
22	*Ciconia nigra*	Black Stork	Winter	LC
23	*Botaurus stellaris*	Great Bittern	Passage	LC
24	*Pelecanus onocrotalus*	Great White Pelican	Winter	LC
25	*Phalacrocorax carbo*	Great Cormorant	Winter	LC
26	*Falco tinnunculus*	Common Kestrel	Winter	LC

Sr. No.	Scientific Name	Common Name	Type	IUCN Status
27	*Falco amurensis*	Amur Falcon	Summer	LC
28	*Falco subbuteo*	Eurasian Hobby	Winter	LC
29	*Falco peregrinus*	Peregrine Falcon	Winter	LC
30	*Milvus lineatus*	Black-eared Kite	Winter	NA
31	*Pandion haliaetus*	Osprey	Winter	LC
32	*Gyps fulvus*	Griffon Vulture	Winter	LC
33	*Aegypius monachus*	Cinereous Vulture	Winter	NT
34	*Circus aeruginosus*	Eurasian Marsh Harrier	Winter	LC
35	*Circus melanoleucos*	Pied Harrier	Winter	LC
36	*Circus macrourus*	Pallid Harrier	Winter	NT
37	*Buteo burmanicus*	Himalayan Buzzard	Winter	NA
38	*Buteo rufinus*	Long-legged Buzzard	Winter	LC
39	*Aquila clanga*	Greater Spotted Eagle	Winter	V
40	*Aquila nipalensis*	Steppe Eagle	Winter	LC
41	*Aquila heliaca*	Eastern Imperial Eagle	Winter	V
42	*Hieraaetus pennatus*	Booted Eagle	Winter	LC
43	*Rallus indicus*	Brown-cheeked Rail	Winter	NA
44	*Porzana pusilla*	Baillon's Crake	Winter	LC
45	*Turnix tanki*	Yellow-legged Buttonquail	Winter	LC
46	*Grus grus*	Common Crane	Winter	LC
47	*Recurvirostra avosetta*	Pied Avocet	Winter	LC
48	*Vanellus cinereus*	Grey-headed Lapwing	Winter	LC
49	*Pluvialis fulva*	Pacific Golden Plover	Winter	LC
50	*Charadrius alexandrinus*	Kentish Plover	Winter	LC
51	*Charadrius mongolus*	Lesser Sand Plover	Winter	LC
52	*Philomachus pugnax*	Ruff	Winter	LC
53	*Gallinago stenura*	Pin-tailed Snipe	Passage	LC
54	*Gallinago gallinago*	Common Snipe	Winter	LC
55	*Tringa erythropus*	Spotted Redshank	Winter	LC
56	*Tringa tetanus*	Common Redshank	Winter	LC
57	*Tringa stagnatilis*	Marsh Sandpiper	Winter	LC
58	*Tringa nebularia*	Common Greenshank	Winter	LC
59	*Tringa ochropus*	Green Sandpiper	Winter	LC
60	*Tringa glareola*	Wood Sandpiper	Winter	LC
61	*Actitis hypoleucos*	Common Sandpiper	Winter	LC
62	*Calidris minuta*	Little Stint	Winter	LC
63	*Calidris temminckii*	Temminck's Stint	Winter	LC
64	*Calidris ferruginea*	Curlew Sandpiper	Winter	LC
65	*Ichthyaetus ichthyaetus*	Pallas's Gull	Winter	LC
66	*Chroicocephalus brunnicephalus*	Brown-headed Gull	Winter	LC
67	*Chroicocephalus ridibundus*	Black-headed Gull	Winter	LC
68	*Gelochelidon nilotica*	Gull-billed Tern	Winter	LC
69	*Sterna hirundo*	Common Tern	Winter	LC
70	*Chlidonias hybrida*	Whiskered Tern	Winter	LC
71	*Rynchops albicollis*	Indian Skimmer	Winter	V
72	*Clamator jacobinus*	Jacobin Cuckoo	Summer	LC
73	*Clamator coromandus*	Chestnut-winged Cuckoo	Summer	LC
74	*Hierococcyx sparverioides*	Large Hawk Cuckoo	Summer	LC
75	*Chrysococcyx maculatus*	Asian Emerald Cuckoo	Summer	LC
76	*Asio flammeus*	Short-eared Owl	Winter	LC

Sr. No.	Scientific Name	Common Name	Type	IUCN Status
77	*Apus pacificus*	Fork-tailed swift	Winter	LC
78	*Merops philippinus*	Blue-tailed Bee-eater	Summer	LC
79	*Jynx torquilla*	Eurasian Wryneck	Winter	LC
80	*Pericrocotus divaricatus*	Ashy Minivet	Winter	LC
81	*Lanius cristatus*	Brown Shrike	Winter	LC
82	*Lanius tephronotus*	Grey-backed Shrike	Winter	LC
83	*Dicrurus remifer*	Lesser Racket-tailed Drongo	Winter	LC
84	*Dicrurus leucophaeus*	Ashy Drongo	Winter	LC
85	*Terpsiphone paradise*	Asian Paradise Flycatcher	Passage	LC
86	*Riparia riparia*	Sand Martin	Winter	LC
87	*Hirundo rustica*	Barn Swallow	Winter	LC
88	*Cecropis daurica*	Red-rumped Swallow	Winter	LC
89	*Locustella naevia*	Grasshopper Warbler	Winter	LC
90	*Phragamaticola aedon*	Thick-billed Warbler	Winter	LC
91	*Acrocephalus stentoreus*	Clamorous Reed Warbler	Winter	LC
92	*Acrocephalus dumetorum*	Blyth's Reed Warbler	Winter	LC
93	*Phylloscopus collybita*	Common Chiffchaff	Winter	LC
94	*Phylloscopus fuscatus*	Dusky Warbler	Winter	LC
95	*Phylloscopus fuligiventer*	Smoky Warbler	Winter	LC
96	*Phylloscopus affinis*	Tickell's Leaf Warbler	Winter	LC
97	*Phylloscopus chloronotus*	Lemon-rumped Warbler	Winter	LC
98	*Phylloscopus inornatus*	Yellow-browed Warbler	Winter	LC
99	*Phylloscopus trochiloides*	Greenish Warbler	Winter	LC
100	*Phylloscopus reguloides*	Blyth's Leaf Warbler	Winter	LC
101	*Cochoa purpurea*	Purple Cochoa	Summer	LC
102	*Luscinia svecica*	Bluethroat	Winter	LC
103	*Luscinia calliope*	Siberian Rubythroat	Winter	LC
104	*Phoenicurus ochruros*	Black Redstart	Winter	LC
105	*Phoenicurus frontalis*	Blue-fronted Redstart	Winter	LC
106	*Saxicola torquatus*	Common Stonechat	Winter	LC
107	*Monticola solitaries*	Blue Rock Thrush	Winter	LC
108	*Ficedula albicilla*	Taiga Flycatcher	Winter	LC
109	*Eumyias thalassinus*	Verditer Flycatcher	Winter	LC
110	*Cyornis rubeculoides*	Blue-throated Flycatcher	Winter	LC
111	*Culicicapa ceylonensis*	Grey-headed Canary Flycatcher	Winter	LC
112	*Niltava sundara*	Rufous-bellied Niltava	Winter	LC
113	*Motacilla flava*	Yellow Wagtail	Winter	LC
114	*Motacilla citreola*	Citrine Wagtail	Winter	LC
115	*Motacilla cinerea*	Grey Wagtail	Winter	LC
116	*Motacilla alba*	White Wagtail	Winter	LC
117	*Anthus richardi*	Richard's Pipit	Winter	LC
118	*Anthus hodgsoni*	Olive-backed Pipit	Winter	LC
119	*Emberiza fucata*	Chestnut-eared Bunting	Winter	LC
120	*Emberiza spodocephala*	Black-faced Bunting	Winter	LC

* CR – Critically Endangered, E – Endangered, LC – Least Concern, NT – Near Threatened and V – Vulnerable

Congregatory Species

Table 4-43 lists the species of birds which display a tendency to congregate in large numbers, ranging from a few hundreds to thousands, and are associated with the region in which the survey-area is situated.

Table 4-43: Details of Congregatory Avian Species

Sr. No.	Scientific Name	Common Name	IUCN Status
1	*Aythya farina*	Common Pochard	LC
2	*Aythya fuligula*	Tufted Duck	LC
3	*Pelecanus onocrotalus*	Great White Pelican	LC
4	*Phalacrocorax fuscicollis*	Indian Cormorant	LC
5	*Phalacrocorax carbo*	Great Cormorant	LC

* LC – Least Concern
Sources: R. Grimmett, C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent (2011); www.iucnredlist.org (2013)

4.13.9 Legally Protected and Internationally Recognized Areas

No known legally protected or internationally recognized area is situated within, or includes any part of, the survey-area.

4.13.10 Ecosystem Services

Provisioning Services

The communities living in and around the survey-area obtain the following products directly from the ecosystems functional therein:

Freshwater
The survey-area contains wells, ponds, streams and rivers that directly provide for the freshwater needs of the local populace.

Cultivation

The species of annual or perennial plants listed in Table 4-44 are cultivated in the soils of the survey-area, including the natural silt deposited in the floodplains of the streams, rivulets and rivers flowing through it.

Table 4-44: Details of Cultivated Plants

Sr. No.	Species	Vernacular Name	Use
1	*Aegle marmelos*	Bel	Fruit
2	*Annona reticulata*	Aatafal	Fruit
3	*Arachis hypogea*	Badam	Nut, Oil-seed
4	*Areca catechu*	-	Betel-nut
5	*Artocarpus heterophylla*	Kaathal	Vegetable, Fruit
6	*Averrhoea bilimbi*	Bilumbi	Fruit, Condiment
7	*Averrhoea carambola*	Kamranga	Fruit, Condiment
8	*Basella alba*	Pui Shak	Leafy vegetable
9	*Cajanus cajan*	Adhad	Pulse
10	*Carica papaya*	Pepe	Vegetable, Fruit
11	*Citrullus vulgaris*	Tamruz	Fruit
12	*Cocos nucifera*	Narikel	Fruit, Sap
13	*Colocasia esculenta*	Kochu Pata	Leafy vegetable, Tuber
14	*Corchorus sp.*	Pat Shak	Leafy vegetable, Fibre

Sr. No.	Species	Vernacular Name	Use
15	*Cucumis sativus*	Shosha	Vegetable
16	*Cucurbita maxima*	Mishti Kumra	Vegetable
17	*Cucurbita moschata*	Kumra	Vegetable
18	*Daucus carota*	Gajar	Vegetable
19	*Emblica officinalis*	Amlaki	Fruit
20	*Guizotia abyssinica*	Guila	Oil-seed
21	*Ipomoea batatas*	Mishti Aalu	Sweet Potato
22	*Lagenaria vulgaris*	Lau	Vegetable
23	*Lens culinaris*	Moshur	Pulse
24	*Lycopersicon esculentum*	Tomayta	Vegetable, Salad
25	*Mangifera indica*	Aam	Fruit, Vegetable, Condiment
26	*Momordica balsamina*	Potol	Vegetable
27	*Momordica charantia*	Korola	Vegetable
28	*Moringa oleifera*	Shojna	Vegetable
29	*Musa sapientum*	Kola	Vegetable, Fruit
30	*Oryza sativa*	Dhaan	Cereal
31	*Phaseolus radiatus*	Mung	Pulse
32	*Psidium guajava*	Piyara	Fruit
33	*Raphanus sativus*	Muli	Vegetable
34	*Solanum melongena*	Begun	Vegetable
35	*Tamarindus indica*	Tetul	Condiment
36	*Vigna sp.*	Borboti	Vegetable, Pulse
37	*Ziziphus mauritiana*	Boroi	Fruit

The species of fishes listed in Table4-45 are commonly cultivated in inland aquaculture ponds by the local communities:

Table 4-45: Details of Cultivated Fishes

Sr. No.	Scientific Name	Common/Vernacular Name
1	*Anabas testudineus*	Koi
2	*Catla catla*	Katol
3	*Chitala chitala*	Chital
4	*Cirrhina mrigala*	Mrigal
5	*Clarias batrachus*	Magur
6	*Ctenopharyngodon idella*	Grass Carp
7	*Heteropneustes fossilis*	Shing
8	*Hypopthalmichthys militia*	Silver Carp
9	*Hypopthalmichthys nobilis*	Bighead
10	*Labeo calbasu*	Kalibaush
11	*Labeo rohita*	Rui
12	*Oreochromis mossambica*	Tilapia
13	*Pungasius pungasius*	Pangash
14	*Wallago attu*	Boal

Note: At least one variety each of goose and duck are cultivated as free-range poultry by the local communities. Their identities could not be ascertained.

Wild (Uncultivated) Foods

The species listed in Table 4-46 are some of the native or naturalized wild plants found in the study-area that provide food to the local communities:

Table 4-46: Details of Wild (Uncultivated) Food Plants

Sr. No.	Species	Habit	Part Used
1	*Amaranthus sp.*	Herb	Vegetable
2	*Amaranthus spinosus*	Herb	Vegetable
3	*Anthocephalus cadamba*	Tree	Fruit
4	*Azadirachta indica*	Tree	Ripe fruit
5	*Carissa carandas*	Shrub	Fruit
6	*Cocos nucifera*	Palm	Sap, Fruit
7	*Dillenia pentagyna*	Tree	Fruit
8	*Eleocarpus floribundus*	Tree	Fruit
9	*Phoenix sylvestris*	Palm	Pith, Sap, Fruit
10	*Pithecellobium dulcis*	Tree	Fruit
11	*Syzigium cumini*	Tree	Ripe fruit
12	*Terminalia catappa*	Tree	Fruit
13	*Ziziphus mauritiana*	Tree	Fruit

A number of species of fishes and other aquatic animals occurring naturally in the water bodies of the survey-area are harvested by the local communities for food.

Fodder

Rice stalks and other agricultural by-products obtained from the plants cultivated in the survey-area serve as fodder for the livestock maintained by the local communities. A number of grasses and forbs growing naturally in pasturelands and fallow fields also serve as fodder for livestock.

Natural Medicines

Table 4-47 lists some plant species, recorded in the survey-area, that are used by the local communities as part of their traditional health-practices.

Table 4-47: Details of Medicinal Plants

S. No.	Species	Part Used	Use
1	*Aegle marmelos*	Fruit	Coolant
2	*Ammania baccifera*	Plant	Purgative
3	*Azadirachta indica*	Leaf, Seed	Germicide
4	*Barringtonia acutangula*	Bark	Tonic
5	*Boerhavia diffusa*	Plant	Tonic
6	*Croton bonplandianus*	Leaf	Relief from skin diseases
7	*Lannea coromandelica*	Leaf	Relief from microbial infections
8	*Melia azedarach*	Leaf, Seed	Germicide
9	*Solanum nigrum*	Fruit	Anti-pyretic
10	*Syzigium cumini*	Fruit, Seed	Relief from Diabetes
11	*Terminalia arjuna*	Bark	Relief from Heart disease, Hypertension

Fuelwood / Biomass Fuel

Trees and shrubs growing in the survey-area are lopped or fallen twigs gathered by the local community for use as fuel wood in their wood-stoves. The invasive aquatic plant, *Eichhornia crassipes*, which grows profusely along the river banks, is also harvested and dried to be used as fuel. Rice-husk, separated from the local rice threshed in the many rice-mills of the area, is compacted into ingots for use as fuel in wood-stoves.

The dung of domestic animals, fed almost entirely by fodder-plants extracted from the local pasturelands, forms a secondary source of biomass used as fuel by the community.

Timberwood

Table 4-48 lists some tree-species, recorded in the survey-area, that provide for the timber wood needs of the local community.

Table 4-48: Details of Timber Wood Trees

S. No.	Species	Vernacular Name
1	*Acacia auriculiformis*	Akashi
2	*Acacia mangium*	Mangium
3	*Albizzia lebbeck*	Shiris
4	*Albizzia procera*	Shil Kodoi
5	*Artocarpus heterophyllus*	Kaathal
6	*Swietenia mahogany*	Kat Ghaash / Mahogani

Fibre

Table 4-49 lists some plant species, recorded in the survey-area, that provide for the fibre-needs of the local community.

Table 4-49: Details of Fibre Plants

Sr. No.	Species	Vernacular Name
1	*Bombax ceiba*	Tula
2	*Corchorus olitorius*	Pat
3	*Corchorus sp.*	Pat

Other Uses

Table 4-50 lists plant species, recorded in the survey-area, that are used for a variety of secondary purposes by the local community.

Table 4-50: Details of Plants having Secondary Uses

Sr. No.	Species	Part used	Product
1	*Cocos nucifera*	Leaf	Broom
2	*Cyperus rotundus*	Stem	Mat
3	*Cyperus sp.*	Stem	Mat
4	*Dendrocalamus strictus*	Stem	Basket, Cage, Trap

5	*Phoenix sylvestris*	Leafs	Thatch
6	*Saccharum spontaneum*	Stem	Broom, Thatch

Sources: Persons interviewed during the survey; United Nations Development Programme & Food and Agricultural Organisation, Integrated Development of the Sundarban Reserved Forest, Bangladesh (1998); Dipankar Saha, Conservation & Sustainable Use of Agricultural Biodiversity; Thilsted S.H., N. Ross & N. Hassan, Role of Small Indigenous Fish Species in Food & Nutrition Security in Bangladesh (ICLARM Quarterly, Jul-Dec 1997); Jakir Hussain, Dewan Muhammad Humayun Kabir & Nazmul Huq, Account of People's Livelihood & Biodiversity of Sundarbans Reserve Forest (Report by Unnayan Onneshan, Dhaka, 2006)

Regulating Services

The natural functioning of the ecosystems in the survey-area, including the mere physical presence of their components, leads to the following processes that benefit the communities living in and around the survey-area.

Ground Water Recharge

The natural water-flows of the survey-area recharge its wells, ponds, lakes, streams and rivers, providing for the freshwater needs of the local populace. The natural vegetation cover also helps slow down the surface run-off, thereby increasing the percolation of water into sub-surface layers and aiding the recharge of the groundwater in the area. Thus, the survey-area contributes to the regulation of the water-regime of the area.

Surface Water Purification

The natural vegetation cover of the survey-area filters the surface and sub-surface run-off, while the life-forms inhabiting the water-bodies of the area, including producers, consumers and detritus feeders, recycle the organic waste in the water. Thus, the survey-area contributes to the regulation of the water-quality of the area.

Erosion Control

The natural vegetation of the survey-area reduces the impact of precipitation on the soil-surface, while the natural ground-cover it creates slows down the surface run-off, thereby reducing erosion of the soil.

Pollination

The natural vegetation of the survey-area creates habitats for a range of fauna that include pollinator-species like bugs, bees, butterflies, moths, birds and bats. Thus, the survey-area provides pollinator-services to natural, as well as, agricultural plants in the area.

Supporting Services

The natural functioning of the ecosystems of the survey-area lead to the following processes that create or maintain the basic natural resources, like soil-nutrients and photosynthetic production, that support human life-sustaining activities like farming, food-gathering, hunting, cooking and grazing of livestock.

Nutrient Capture and Recycling

The flora and fauna of the survey-area, through the countless food-chains they constitute, capture, transfer and recycle a range of nutrients in the environment. Such nutrients primarily include the carbon, nitrogen and oxygen, and their natural compounds, in the environment of the area.

Biomass generated by the survey-area and transferred by water and wind helps recharge the soil-fertility in the surrounding area. Thus, the natural vegetation and topography of the survey-area contribute to the natural productivity of area.

Primary Production

The photosynthetic organisms of the survey-area act as primary producers, creating food-reserves that support the fauna of the area. This primary production, amongst other food-materials, includes a large variety of phytoplankton and the various parts and products of higher plants, such as leaves, flowers, pollen, flower-nectar, fruits and seeds.

4.13.11 Salient Findings of the Survey

- The survey-area contains remnants of at least three types of natural forests native to the region, with their natural vegetation profile altered to varying extents. (Details in Section 4.12.2 of this report)
- The survey-area contains modified habitats in the form of farmlands, orchards, plantations, aquaculture ponds, habitations, village ponds, embankments, roads and jetties. (Details in Section 4.12.5 of this report)
- The survey-area contains natural habitats, in the form of small communities or individuals of native species, distributed over patches of natural forest, marshes and natural water bodies.
- The survey-area supports at least fifty-eight species of woody and thirty-three species of non-woody higher plants, comprising both native and exotic species, as recorded during a preliminary investigation of nine locations in the survey-area. (Details in Section 4.12.6 of this report)
- At least sixty-eight species of mammals, one hundred and fifty-seven species of birds, seventy-two species of reptiles, ten species of amphibians and seventy-three species of fishes are likely to be resident in and around the survey-area. (Details in Section 4.12.6 of this report)
- At least twelve invasive alien species have been recorded from the survey-area, some of which are likely to have been introduced through the ballast-waters of sea-vessels. (Details in Section 4.12.7 of this report)
- The survey-area contains the natural habitats of at least four species of mammals, five species of birds and five species of reptiles that are designated by the IUCN as ‘Critically Endangered’ or ‘Endangered’. (Details in Section 4.12.8 of this report)
- The survey-area contains the natural habitats of at least two species of mammals, four species of birds, three species of reptiles, one species of amphibians and three species of fishes that are endemic or near-endemic to or have restricted ranges that include the region in which the survey-area is situated. (Details in Section 4.12.8 of this report)

- The survey-area coincides with a globally important avian migratory flyway, namely, the Brahmaputra river-system.
- At least one hundred and twenty species of migratory birds, including winter, summer and passage visitors, are associated with the region in which the survey-area is located. (Details in Section 4.12.8 of this report)
- At least five species of congregatory birds are associated with the region in which the survey-area is located. (Details in Section 4.12.8 of this report)
- Studies suggest that the waterways of the Brahmaputra river-system, which includes the part of the Meghna river falling within the survey-area supports significant numbers of an endangered species of freshwater dolphin, the Ganges River Dolphin (*Platanista gangetica*).
- Studies suggest that freshwater dolphins exhibit dependency on abundant freshwater-flow, making them particularly vulnerable to upstream water-abstraction. As top-feeders of food-chains, they are also particularly vulnerable to pollution. They are also known to be particularly vulnerable to risk of collision with water-transport while calving or nursing.
- Studies suggest that thermal pollution has increased effects in tropical areas, where organisms are already near their thermal tolerance limits.
- Several traditional human habitations exist within the survey-area.
- The local communities depend on the survey-area for water, cultivated foods, wild (uncultivated) foods, traditional medicines, fuel, fodder, fibre, timber and various secondary needs. (Details in Section 4.12.10 of this report)
- Any loss, degradation or fragmentation of the habitats in and around the survey-area is likely to quantitatively and qualitatively degrade the ecosystem services provided by the survey-area to both, human and non-human organisms dependant on them. (Details in Section 4.12.10 of this report)

5. SOCIO-ECONOMIC BASELINE & STAKEHOLDER CONSULTATION

This chapter discusses the profile of the existing demographics and socio – economic conditions in the project influenced villages around the project area. Consultations with various stakeholders and their identification and mapping have also been provided to showcase their influence and interest level over the project.

As part of the ESIA study, stakeholder identification, stakeholder analysis, consultation, public awareness, disclosure and grievance redressal are important components which are required to be undertaken in a project to maintain transparency and sense of ownership among the local communities in the area. The following aspects are encompassed within the process of stakeholder engagement:

- To identify the key stakeholders of the project and assess the power relationships as well as the level of influence and interests of the stakeholders involved in the development of the project.
- Undertake a stakeholder analysis to categorise the most important actors for the preparation, design, implementation and monitoring of the proposed project.
- Undertake consultations with the local communities likely to be influenced by the project as well as stakeholders like Non Governmental Organisations (NGOs) and Civil Society Organisations (CSOs).
- Examine opportunities and conditions for the participation of the stakeholders including vulnerable groups in the project cycle.
- The project being categorised as 'Category A' as per the World Bank Environment Assessment Policy (OP 4.01), the stakeholders are required to be consulted twice: a) in meetings held during the screening and scoping stage and b) when a draft EIA is made available, it is a requisite that a summary of the report is to be translated in the local language and displayed to the public in a locally accessible location prior to the meeting. Various forms of consultations like public meetings, focus group discussions, one-to-one interviews etc. should be adapted to the stakeholders with the goal of ensuring a broad and meaningful engagement process.
- To disseminate relevant materials to the influenced groups in a timely group manner both prior and post consultations and in a form and language that is understandable and accessible to the groups being consulted. Records of all prior and current consultations are to be maintained and updated regularly.
- To develop a Grievance Redressal Procedure to respond to queries and address any complaints, disputes and grievances regarding any aspect of the project. This procedure should include the mechanism and composition of the Grievance Redress Committee (GRC) involving NGOs, local elites and representatives of local government to ensure accountability and transparency of the grievances addressed.
- To describe the disclosure requirements of environmental and social documents at different stages of the project and guide the project proponent to disclose the same so that the stakeholder consultation, full information on the designs and environmental and social impacts and mitigation measures are properly disclosed and made accessible to the local population.

5.1 Study methodology

5.1.1 Delineation of the Project Influenced Area

The considered 'study area' for the social impact assessment would include areas falling within 2 km radius of the project area (using the site location as the central point). For the purpose of establishing the existing demographic and socio – economic conditions of this area, all villages and wards falling within this 2 km were identified and delineated as the 'Project Influenced Villages.'

5.1.2 Desk Based Review

A desk based review was undertaken and existing documents and data were studied to get a preliminary understanding of the project area and the project influenced population. The websites and reports that were reviewed for the study have been provided as follows:

- Population and Housing Census Data, 2011 (of villages located within 2 km radius of the project site under Ashuganj Union, Bhairab Union, Durgapur Union and Char Chartola Union);
- The Bangladesh Gender Statistics report (2012);
- The Country report by UNICEF (2012);
- Agricultural Census Data, 2008 by Bangladesh Bureau of Statistics;
- Economic Census Data, 2003 by Bangladesh Bureau of Statistics;
- Country's Health and Morbidity Status Survey 2012;
- Bangladesh Literacy Survey Report, 2010 by Bangladesh Bureau of Statistics;
- World Bank' Bangladesh Poverty Assessment Report 2000-2010;
- Bangladesh's Local Government Engineering Department Statistics;
- Report on Monitoring of Employment (Labour Force) Survey,2009 ;
- Report on Household based Livestock and Poultry Survey, 2009 by Bangladesh Bureau of Statistics;
- Report on Welfare Monitoring Survey, 2009 by Bangladesh Bureau of Statistics;
- Copy of No Objection Certificate (NOC) from Ashuganj Union Parishad;
- Copy of Environment Site Clearance Certificate from Department of Environment, Chittagong Divisional Office;
- Copy of Environment Clearance, Department of Environment;
- Copy of Land Lease Agreement between Ashuganj Power Station Company Limited and United Ashuganj Energy Limited;
- Copy of Environment Impact Assessment (EIA) Study Report submitted by Adroit Environment Consultant Ltd.;

5.1.3 Study Tool

Based on the desk based research and assessment of the previous EIA report, two questionnaires were prepared. The first questionnaire was a 'Village Inventory' designed to capture the village demographics, literacy levels, occupational patterns, access to basic amenities and the general socio - economic status of various strata in the community. The second questionnaire was a 'community perception questionnaire' and designed to capture project relevant details such as the community's understanding, apprehensions and expectations from the project. It also contained provisions in

understanding the development needs of the people, whilst indicating the priority amongst those needs. The same questionnaires were also used to conduct group interviews amongst community members. Sample copies of the two questionnaires have been attached as Annexure XIV of the report.

A reconnaissance survey was undertaken to the study area from 20th to 23rd April 2015 to cover the socio-economic aspect of the study population. A schedule to undertake the survey and interviews were drawn up so that all the required tasks could be completed within the timeframe (Table 5-1).

Table 5-1: Schedule for the Socio-Economic Survey and Stakeholder Consultation

S. No.	Tasks	Scheduled Date
1	Consultations with UAEL Staff	20th & 22nd April 2015
2	Socio-Economic Survey & interviews with local community	21st -22nd April 2015
3	Interviews with other Stakeholders	22nd April 2015

5.1.4 Observation, Side Notes and Data Validation

Observations were made on village conditions, type of houses, access to essential utilities, sanitation facilities, socio-economic conditions and communal harmony. These were used to corroborate the primary and existing secondary data (census). Side notes were taken during public consultations and all information was triangulated[13] as much as possible to maintain accuracy and validity. Finally, the relevant data was utilised to supplement the secondary data to construct the demographic and socio – economic profile of the project influenced area.

5.1.5 Stakeholder Analysis

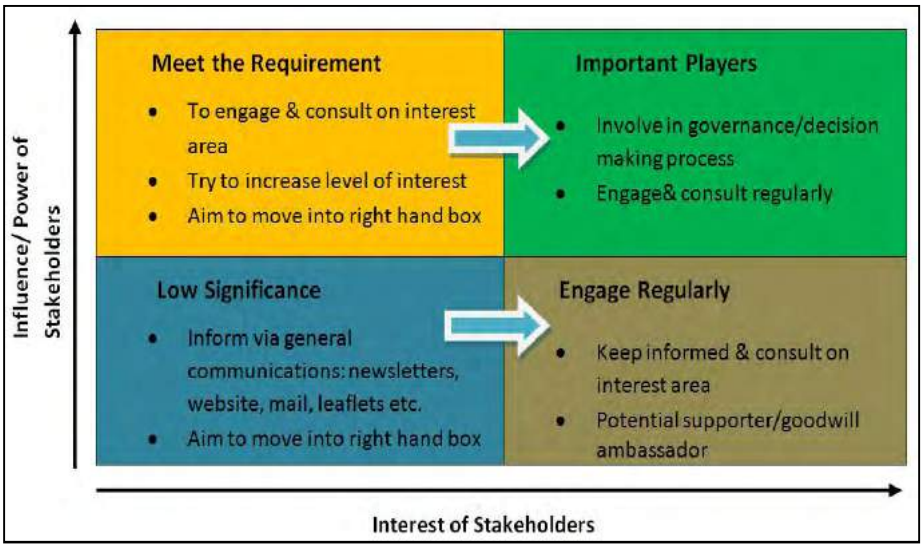
The process of stakeholder consultation was initiated with the identification of stakeholder by assessing the level of interest and influence of the stakeholders and their power relationship towards the project. Once the tentative stakeholders were shortlisted, they were grouped into identifiable groups of people with similar interest. The stakeholder were then mapped to a matrix to showcase the stakeholder groups and their interest areas which also helped to develop a communication plan assigned to each stakeholder's focus and concerns.

Once the interest of the stakeholders was mapped they were categorized in terms of importance. To initiate this step, a common approach of mapping the interest and power or influence of each stakeholder group on a quadrant (power/interest grid) was drawn out.[14] This step was to assess the interest/influence into high, medium and low as well as to assess the power relationship, impact, support and attitude of the various identified stakeholders. In the grid as mentioned, it shows that the stakeholders which fall within the left grid have scope of diverting to the sections on the right grid over some given amount of time. The following (Figure 5-1) highlights the power/interest grid that would be used to categorized the stakeholders.

[13] Triangulation is a technique that facilitates validation of data through cross verification from at least three different sources.
[14] Bryson J. (1995) *Strategic Planning for Public and Non Profit Organization* (rev. edn.), San Francisco: Jossey – Bass; Pg-71-75.

To initiate the stakeholder engagement process, two levels of engagements were focused upon. The first comprised of a socio-economic survey to understand the socio-economic status of the study population including the concerns/issues and expectations of the local community and second, conduct of focus group discussions and one-to-one interviews to gather the viewpoints of the various identified stakeholders as well as disclose information on the project and respond to queries of concerns and aspirations raised in a neutral manner.

Figure 5-1: Power/Interest Grid of Stakeholders



Source: Adapted from Eden and Ackermann (1998: 121-5, 344-6)[15]

A simple random sampling method was adopted to undertake the socio-economic survey comprising of a list of open-ended and close ended questions. The target of the socio-economic survey was to understand the views of project influenced population located within the 2 km radius of the project site.[16] The criteria of identifying and consulting this population were based on the proximity to the site area and the prevailing socio-economic characteristics. Besides the local population, members of local governing institutions, opinion leaders and NGO's working in the area were identified and interviewed to incorporate the views of other stakeholders as well.

5.2 Administrative Set Up

Bangladesh is divided in to seven divisions for administrative convenience (Figure 5-2). Each division is further divided into districts (Zilas) and each district, in to sub districts or Upazilas. Hence, Bangladesh has 64 districts and 1,009 sub districts. Each Upazilla is divided into unions (the administrative body governing a cluster of villages) and Paurashava (the administrative body governing a cluster of urban wards.). Both, Unions and Paurashava are self governing councils and the smallest electoral units as well.

[15] Eden C. and Ackermann F. (1998) *Making Strategy: The Journey of Strategic Management*, London: Sage Publications; Pg: 121-5, 344-6.

[16] As Paltakanda and Bhairab Bazaar both falls on the opposite shore of the Meghna River, while undertaking the consultation process, more focus was given to Paltakanda than Bhairab Bazaar because of the resident fishing community inhabiting the village. Hence, Bhairab Bazaar being slightly further away from the project area has been excluded from the socio-economic survey as well as the consultations process.

Details of the number of administrative units under the districts of B.Baria and Kishoreganj have been provided in (Table 5-2).

Figure 5-2: Administrative Structure in Bangladesh and the Site Location

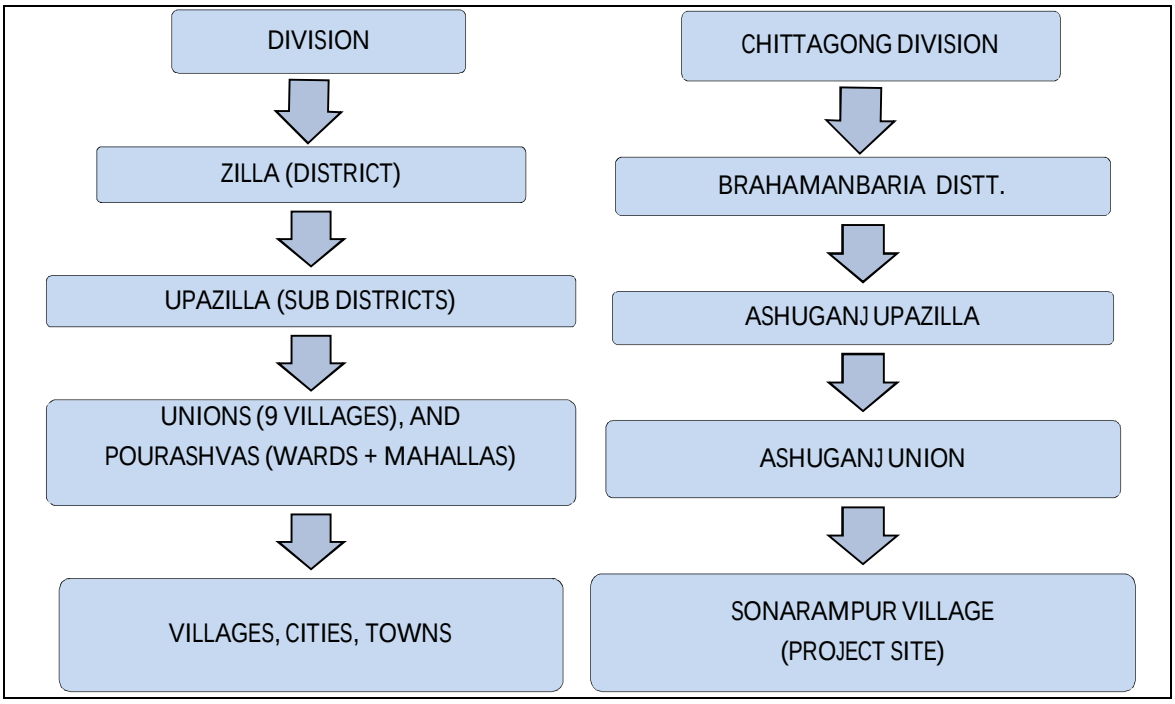


Table 5-2: Administrative Unites under Brahmanbaria and Kishoreganj Districts

Sr. No	Administrative Unit	Brahmanbaria Zila	Kishoreganj Zila
1	Upazilas (Sub – Districts)	9	13
2	Unions *	100	108
3	Moauza (village agglomerations)	900	841
4	Villages	1,323	1,725
5	Paurashava #	4	8
6	Paura Ward	39	75
7	Paura Mahalla	109	228

* The administrative body governing a cluster of villages.
# The administrative body governing a cluster of urban wards.
Source: Bangladesh Census 2011 data sheets

5.2.1 Districts Overview

Brahmanbaria or B. Baria as it is commonly known, has a total population of 28,40,498 persons, which is just 1.97% of Bangladesh's population whereas, Kishoreganj, with a population of 29, 11, 907 persons, equals to 2.02 % of the country's total population.

With a total area of 464856 acres, B.Baria has a population density of 1510 persons/ sq. km. In comparison, Kishoreganj, with a total area of 664356 acres, has a population density of 1083 persons/ sq. km. Both districts have more females than males with sex ratios indicating 93 males per 100 females (B.Baria) and 97 males per 100 females (Kishoreganj). The overall literacy rate for B. Baria is approx. 45% and for Kishoreganj it is about 40% having the rates similar between both male and females.

The main occupations in both districts are agriculture, fishing and aquaculture, and rice processing. B. Baria is also known for the fertilizer factory at the Ashuganj Industrial Hub.

5.3 Socio-Economic Profile

A total of seven villages were identified within the demarcated study area (Table 5-3). Five of the villages are from Ashuganj Upzila in Bhramanbaria District and rest two are from Bhairab Upzila of Kishoreganj District.

Table 5-3: List of the Project Influenced Villages

S. No.	Village	Union/ Paurashva	Upazilla (Sub District)	District	Approx Distance From site
1	Sonarampur	Ashuganj	Ashuganj	Brahmanbaria	0.5 km
2	Ashuganj				0.5 km
3	Char Sonarampur				1 km
4	Char Chartala	Char Chartola			1.7 km
5	Shohagpur	Durgapur			1.6 km
6	Bhairab Bazar	Bhairab Paurashava	Bhairab	Kishoreganj	2 km
7	Paltakanda				2 km

The following section provides a detailed overview of the social demographics within the Project Influenced Area.

5.3.1 Area and Population

Bangladesh is densely populated country, with its worldwide ranking being 8. Amongst the two districts, B. Baria district has a higher density with 1510 persons / sq km. Although the two Upazilas have similar density, they are less dense than the unions – with Char Chartala Union being the densest (4050 persons/ sq. km).

Amongst the project influenced villages, Char Chartala has the highest population with 25,789 persons while Char Sonarampur has the least, with a population of just 1508 people. Details of the different areas and its population have been provided in (Table 5-4).

Table 5-4: Area and Population of Project influenced Villages

S. No.	Administrative Unit	Area in Acres	Total Households	Population	Population density [sq. km]
1	Brahmanbaria Zila	464856	538937	2840498	1510
2	Kishoreganj Zila	664365	627322	2911907	1083
3	Ashuganj Upazila	16702	33552	180654	2673
4	Bhairab Upazila	34427	58940	298309	2141
5	Ashuganj Union	2799	6816	35110	3100
6	Char Chartala Union	1572	5033	25789	4054
7	Durgapur Union	3038	6023	34748	2826
8	Bhairab Paurashava	#	24057	118992	#
Villages					
1	Sonarampur	#	1712	8270	#
2	Ashuganj	#	1271	6422	#
3	Char Sonarampur	#	290	1508	#
4	Char Chartala	#	5033	25789	#

5	Shohagpur	#	1908	11311	#
6	Bhairab Bazar	#	1743	8328	#
7	Paltakanda	#	787	3987	#

Data Unavailable.

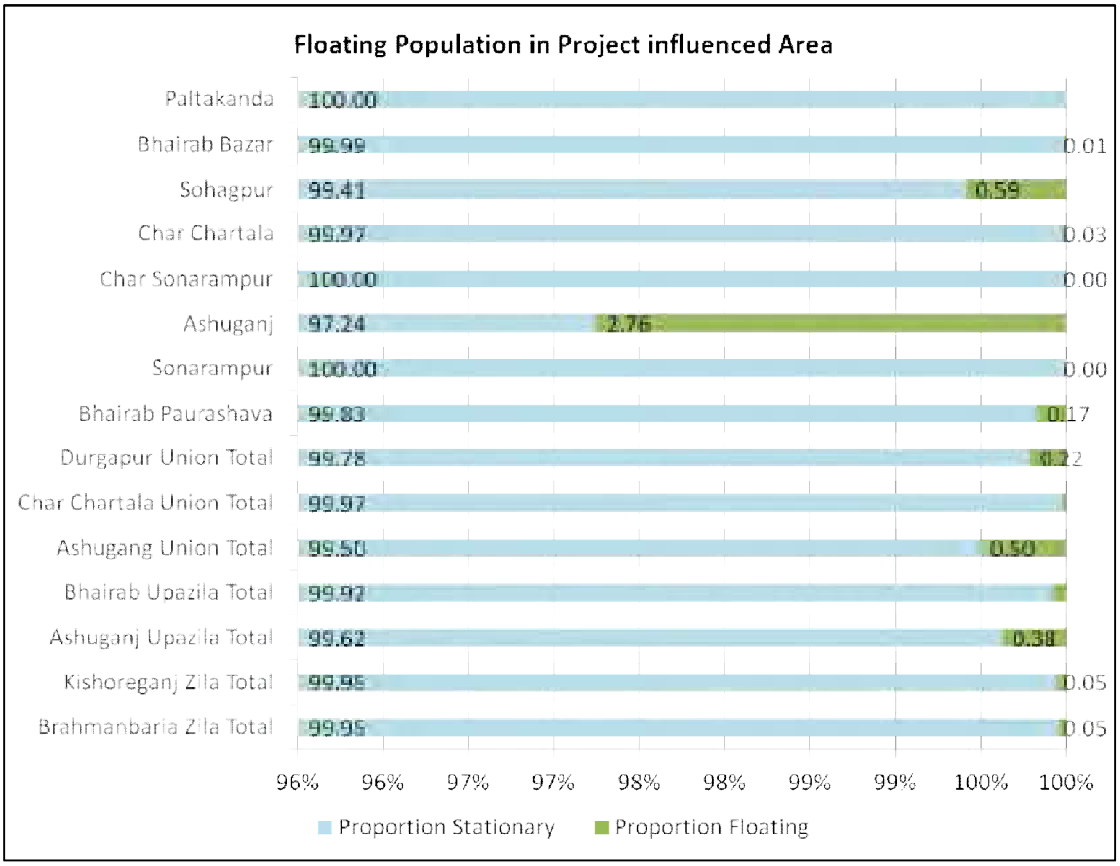
5.3.2 Non stationary and Migrant Populations

'Floating population' is a terminology used to describe a group of people who reside at a location for certain amount of time, are not generally considered to belong to that place especially during official census counting. The Bangladesh Bureau of Statistics refers to nomadic or migrant populations as 'floating populations'. While the Chittagong division has a sizable tribal population, the study area neither have nomadic tribes, nor are there any recorded tribal populations living in the project influenced villages.

There is, however a large migrant population in some parts of the area, comprising of families that work as daily wage labourers at Ashuganj rice mills and Ashuganj bamboo market. In addition, during site visit, there were fishing families who reported to move from place to place depending upon the season, quality and quantity of fish.

As is evident from (Figure 5-3) Ashuganj village has a relatively high proportion of 'floating population' (2.76%) most likely indicative of the rice mill workers living and working in the area. This fact was ascertained during consultations held with several rice mill workers, the union heads and the Ashuganj Upazila Nirbahi Officer during the site visit.

Figure 5-3: Floating Population in Project influenced Area



5.3.3 Household Size

The mean household (HH) sizes for all villages is mostly between four (4) to six (6) persons per family, except Shohagpur where the highest proportion of families have over eight (8) family members (20.5 %) . Bhairab Bazaar has a high proportion of families with a HH size of 4 persons (24.3 %). Details of the same have been provided in (Table 5-5).

Table 5-5: Household size in Population Influenced Area

Sr. No.	Administrative Unit	Percentage of Households comprising of following no. of persons:								Average HH Size
		1	2	3	4	5	6	7	8+	
1	Brahmanbaria Zila	2.3	7.2	12.9	18.5	19	15.2	10.1	14.9	5.3
2	Kishoreganj Zila	4.3	10.1	16.1	20.9	19.2	13.3	7.7	8.3	4.6
3	Ashuganj Upazila	2.5	6.6	12.1	17.6	18.7	15.8	10.7	15.9	5.4
4	Bhairab Upazila	3.1	8.4	13.9	18.9	18.8	15	9.8	12	5
5	Ashuganj Union	2.9	7.2	13.2	19.3	19	15.2	9.8	13.4	5.1
6	Char Chartala Union	2.7	7.1	14	20.6	19	13.9	9.8	13	5.1
7	Durgapur Union	1.4	4.9	10.8	16.2	17.5	16.6	12.3	20.4	5.8
8	Bhairab Paurashava	2.9	8.7	15.6	20.9	19.3	13.9	8.1	10.6	4.9
Villages										
1	Ashuganj	2.9	8	12.9	22	18.1	15.3	10.4	10.4	5
2	Sonarampur	4	7.8	13.8	23.7	18.1	14.4	7.9	10.3	4.8
3	Char Sonarampur	3.8	3.8	12.8	15.5	24.5	15.9	13.1	10.7	5.2
4	Char Chartala	2.7	7.1	14	20.6	19	13.9	9.8	13	5.1
5	Shohagpur	1.2	4.3	9.5	15.9	19.4	16.1	13	20.5	5.9
6	Bhairab Bazar	2.3	6.2	19.9	24.3	19.3	11.3	7.1	9.5	4.7
7	Paltakanda	1.5	8.6	12.9	19.4	21.5	13.3	10.5	12.2	5.1

5.3.4 Age Composition

When segregated by age groups, one can observe that the largest proportion of population falls within the age group of 15 to 59 years (Figure 5-4). Economically, this segment of the population is considered most productive and draws a major proportion of their family income. Demographically, this segment is considered the most capable, healthy and fertile (15 – 45 years). It may be hence generalised that this proportion of the population is economically more independent and the other segments with the remaining population being dependent on this age group.

5.3.5 Gender Statistics and Sex Ratios

According to Bangladesh's Gender Statistics report (2012), the female population within the age-group 0 -15 has decreased from 46.8 in census 1981 to 33.8 in 2011. For the male population in the same age group, it has decreased from 46.5 in census 1981 to 35.5 in 2011. This indicates a decrease in the birth rates, and subsequently the overall population.

The Gender Statistics report also indicates that 30.8 % and 40. 9 % of females within the age group of 15 – 19 years, in Chittagong and Dhaka divisions respectively, are married. Early marriage was pointed out as a major issue by several stakeholders during consultations with them. There stakeholders were the union heads of Char Sonarampur and Char Chartala, a senior doctor at a popular private hospital in Char Chartala and two NGO representatives.

Figure 5-4: Total Population with Age - Wise Approximates

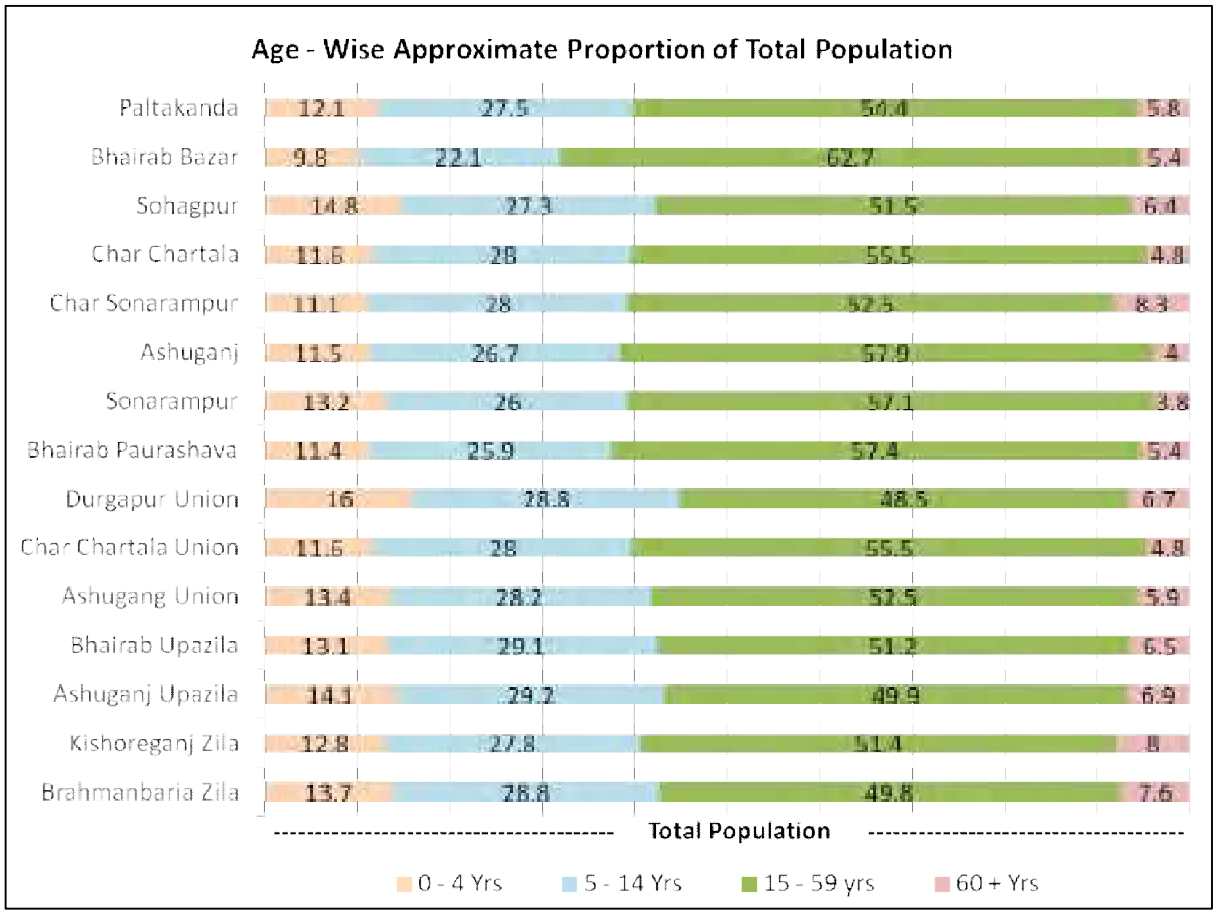


Table 5-6: Proportion of women Married: Segregated by Age Group

S. No	Division	Percentage of women 15-19 years married	Percentage of Females married before age 15	Percentage of Females married before age 18
1	Chittagong	30.8	21.9	66.5
2	Dhaka	40.9	32.9	72.1

Source: Gender Statistics Report (2012), Bangladesh Bureau of Statistics

All respondents felt that it was one of the main reasons for young girls discontinuing education. The doctor however opined that early marriage was a major contributing factor to the high cases of complicated deliveries that the hospital handled. He reported that most complications relating to child birth were due to either the young age of the mother, her short stature, poor nutritional status, lack of hygiene and choosing to have home base birth. He contributed all these factors to the young mother's lack of education and early marriage.

At the same instance, cumulative figures for Bangladesh indicate that the mean age at marriage is 18 years for women and 23 years for men. This indicates that there is an equally large segment of the society that promotes and practices marriage at a relatively older age.

Traditionally, Women in rural Bangladesh are not encouraged to work or seek employment outside of home and the nation's 2010 data on Gender Equality estimates that only 18 % of the total non - agricultural sector employed persons are women.

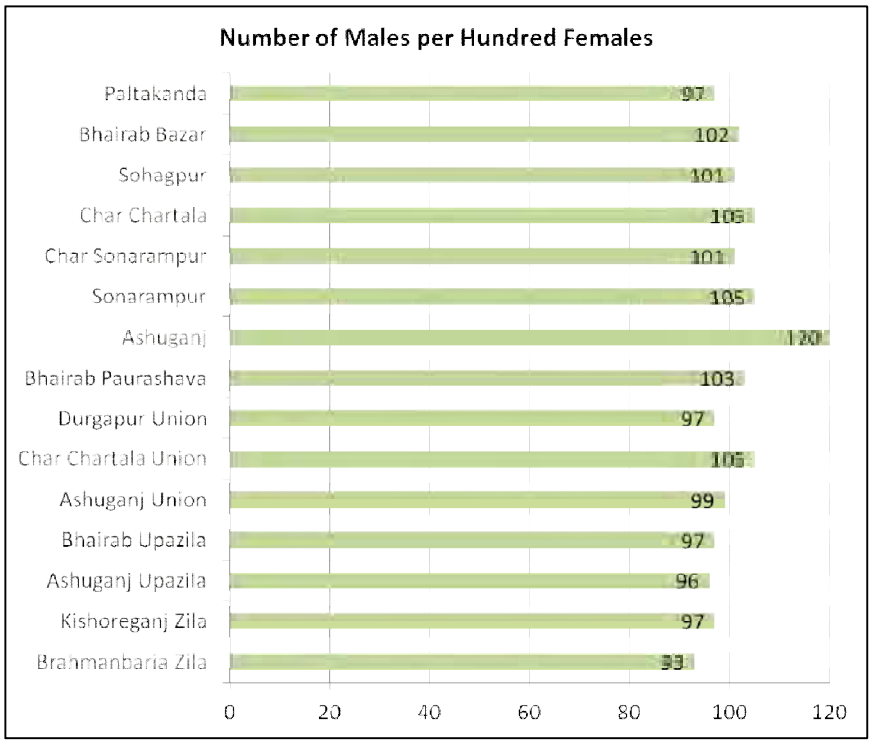
Sex Ratios

Sex ratio is the ratio of males and females in a population. Although the proportion, that indicates a healthy sex ratio, remains a contested one, the WHO recommends a ratio of at least 1:1 (1 female: 1 male) if not more. Unlike most developing Asian nations, Bangladesh does not have a severely skewed sex ratio. The country's average figure is 95 males per 100 females. Skewed sex ratios indicate a strong gender bias in a society, such as preference for males over females, to the extent of sex selective foeticide and infanticide. However, Bangladesh's Gender Statistics report (2012) and the country UNICEF report (2012) does not highlight indicators that show this strong a preference towards males, and skewed sex ratios are most likely resultant of other reasons such as limited access to health care and maternal health services.

In 1981, Bangladesh had approximately 107 males for every 100 females. The figure remained unchanged at 106 for 1991 and 2001, and then equalised to 100 by 2011. As of 2014, Bangladesh had 95 males per 100 females, indicating a gender friendly and healthy sex ratio. The sex ratio at birth recorded during census enumeration in 2011, however, indicated 104 males/ 100 females.

Amongst the villages, Paltakanda has the least number of males per 100 females (97). All other villages have sex ratios that indicate more males than females. However, at the Upazilla and district levels, ratios tilt in favour of females, with there being fewer males than females in the population (Figure 5-5).

Figure 5-5: Sex Ratio in Project Influenced Area



The World Bank estimated a Maternal Mortality Ratio (MMR) of 170 in 2013, indicating an approximate 170 maternal deaths for every 1,00,000 live births in the country. Maternal Death refers to the death of a woman due to pregnancy or birth related causes. High Maternal mortality ratios are reflective of a culmination of several factors such as limited access to medical care, poor medical facilities, restrictive societal norms and lack of reproductive rights for the women. Currently Bangladesh ranks 49th amongst 189 countries with respect to the MMR (with the 1st rank having the highest ratio)

During consultations with women, it was reported that most preferred to have a home based birth, with assistance from a trained birth attendant, a local birthing attendant or a family relative.

5.3.6 Literate Population

Bangladesh measures its literacy rate, amongst population 15 years and above, by their ability to 'read and write a letter'. With the proportion of literate population amounting to 43.1%, Bangladesh is ranked 151 in its comparison to literacy rates in other countries.

The literacy rate in Bangladesh is low overall, and is not affected by gender variables. This trend can be seen in the project influenced area as well, as there is very little disparity between literacy rates of males and females within their respective populations. Furthermore, the 2012 UNICEF Country Report reported a higher proportion of adolescent girls being educated (80.4%) than adolescent boys (77%).

Amongst the villages, Shohagpur has the highest literacy rate at 61.9% and the villages of Char Sonarampur and Paltakanda the least, with only 26.3 % and 27.6% being literate. As can be observed in (Table 5-7), the difference in literacy rates amongst the unions, upzilas and districts is comparatively less.

During the site visit it was ascertained that residents of both Paltakanda and Char Sonarampur are primarily fishing communities with comparatively lower economic statuses than other communities. While Paltakanda is a busy fish market with good access to primary, middle and high schools; Char Sonarampur is a small island in the middle of River Meghna with no electricity and very limited access to schools and health care.

Table 5-7: Proportion of Literate Population in Project Influenced Area

S. No.	Administrative Unit	Literate Population		
		Total	% Males	% Females
1	Brahmanbaria Zila	45.3	45.7	44.9
2	Kishoreganj Zila	40.9	41.5	40.3
3	Ashuganj Upazila	51.2	52	50.4
4	Bhairab Upazila	42.7	43.4	42
5	Ashuganj Union	49.4	51.1	47.7
6	Char Chartala Union	55	56.7	53.1
7	Durgapur Union	50.5	51.4	49.6
8	Bhairab Paurashava	53.6	55	52.2
Villages				
1	Sonarampur	59.5	62.3	56.5

S. No.	Administrative Unit	Literate Population		
		Total	% Males	% Females
2	Ashuganj	59.5	61.9	56.5
3	Char Sonarampur	26.3	27.5	25
4	Char Chartala	55	56.7	53.1
5	Shohagpur	61.9	63.4	60.3
6	Bhairab Bazar	70	72.6	67.4
7	Paltakanda	27.6	26.9	28.4

5.3.7 Ethnicity

Bangladesh has an ethnically homogenous population. However, the country's population also includes certain tribes and other communities. The Chakmas, Marmas, Tipperas and Mros are the four largest Indigenous tribes in Bangladesh. Other ethnically different communities include the Bihari, Oraons, Mundas and Rohingya Muslims.

The districts of Sylhet and Mymensingh and the region of Chittagong Hill Tracts have the largest proportions Indigenous populations within the country, these being the Meitei, Lusai, Khasi, Santhals, Chakma and the Garo.

As per the 2011 census, B. Baria district has 71 Chakmas, 11 Marmas, 10 Lusai and 26 persons from other tribes. Kishoreganj District has 297 Chakmas, 39 Marmas, 36 Lusai and 64 persons from other tribes. Ashuganj Upazilla and the villages under its administration have no recorded tribal population. However, Bhairab Upazilla has 30 Lusai persons, with 11 of them living in Bhairab Paurashava.

5.3.8 Religious Composition

Bangladesh's population is primarily Muslim. As per the 2011 census records, approximately 89% of the population are Muslims, 8% Hindus, 1 % Buddhists and 0.5 % Christians.

All project influenced villages have the highest proportion of their populations following Islam, with the exception of two villages, namely, Char Sonarampur and Bhairab Bazar. While Bhairab Bazar has a Muslim population of only 59%, Char Sonarampur has primarily Hindu population with Hindus comprising of 90.6 % of its population. Char Chartala also has a small Christian population (10 persons) and Buddhist Population (6 persons). Details of the religious composition of population in project influenced areas have been provided in (Table 5-8).

Table 5-8: Religions followed in Project Influenced Area

S. No	Administrative Unit	Muslim		Hindu		Christian	Buddhist	Others
		Actual No.	%	Actual No.	%			
1	Brahmanbaria Zila	2627810	92.5	211899	7.5	389	118	282
2	Kishoreganj Zila	2752007	94.5	158538	5.4	269	19	1074
3	Ashuganj Upazila	172249	95.3	8336	4.6	18	12	39
4	Bhairab Upazila	286457	96.0	11815	4.0	32	4	1
5	Ashuganj Union	32415	92.3	2689	7.7	6	0	0
6	Char Chartala Union	25370	98.4	403	1.6	10	6	0
7	Durgapur Union	34583	99.5	165	0.5	0	0	0
8	Bhairab Paurashava	110875	93.2	8082	6.8	30	4	1

S. No	Administrative Unit	Muslim		Hindu		Christian	Buddhist	Others
		Actual No.	%	Actual No.	%			
Villages								
1	Sonarampur	7970	96.4	294	3.6	6	0	0
2	Ashuganj	5598	87.2	824	12.8	0	0	0
3	Char Sonarampur	141	9.4	1367	90.6	0	0	0
4	Char Chartala	25370	98.4	403	1.6	10	6	0
5	Shohagpur	11287	99.8	24	0.2	0	0	0
6	Bhairab Bazar	4915	59.0	3413	41.0	0	0	0
7	Paltakanda	3864	96.9	123	3.1	0	0	0

5.3.9 Workforce Participation

The Bureau of Statistics defines the working population as persons aged 7 years and above who are not studying but engaged in some economic activity. Of the total employable population in the entire study area, between 17 - 30 % are currently unemployed, with Kishoreganj Zila having the least proportion (17.8%) and Shohagpur, the highest (30%). As is evident in Table 5-9 and Figure 5-6 between 30 to 40% of the population are employed in household work.

Table 5-9: Details of Workforce Participation in Project Influenced Areas

S. No.	Administrative Unit	Proportion: Employable Population*	Employment Status			
			Employed	Looking for work	Household work	Unemployed
1	Brahmanbaria Zila	29.7	34.8	0.8	43.9	20.6
2	Kishoreganj Zila	33.1	39.8	0.5	41.9	17.8
3	Ashuganj Upazila	26.4	38.8	0.8	37.2	23.2
4	Bhairab Upazila	28.3	38.0	0.5	40.0	21.5
5	Ashuganj Union	27	42.4	1.0	33.1	23.5
6	Char Chartala Union	24	40.8	0.7	33.5	25.0
7	Durgapur Union	27.3	43.4	0.9	31.3	24.4
8	Bhairab Paurashava	23.9	40.6	0.5	35.7	23.2
Villages						
1	Sonarampur	25.1	55.7	0.7	21.2	22.4
2	Ashuganj	23.2	49.9	1.2	24.7	24.3
3	Char Sonarampur	45.4	41.5	0.9	40.4	17.3
4	Char Chartala	24	40.8	0.7	33.5	25.0
5	Shohagpur	22.4	45.0	0.9	23.9	30.2
6	Bhairab Bazar	17.9	45.7	0.8	37.1	16.4
7	Paltakanda	33.9	40.2	0.5	34.2	25.1

*Indicates Population aged 7+ and not attending school.

When segregated by gender, the work profile of men and women can be seen drastically different (Figure 5-6 and Figure 5-7) While men work under outside employment the maximum, the women are engaged the maximum in household activities.

5.3.10 Occupational Patterns

The Census 2011 report classified the working population by the sector. The highest proportion of workers draw income from agriculture and allied activities, followed by industries and, lastly by services.

Figure 5-6: Workforce Participation amongst Male Population

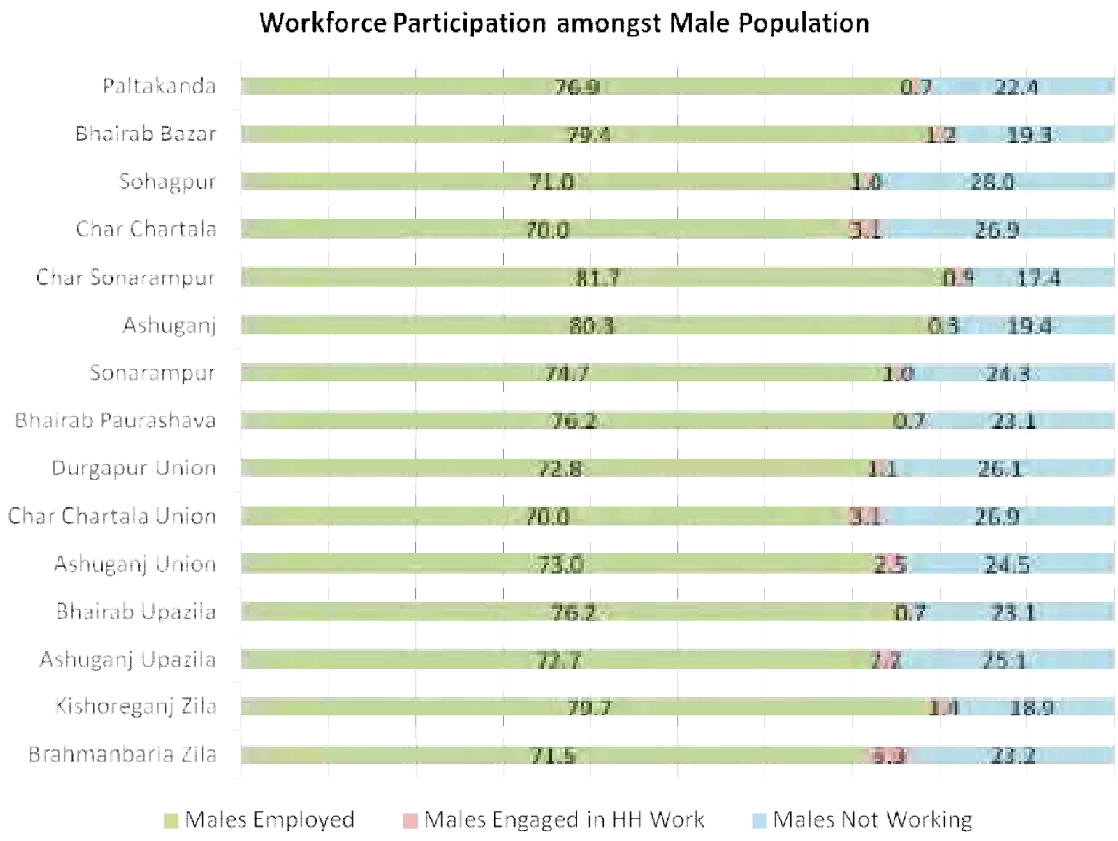
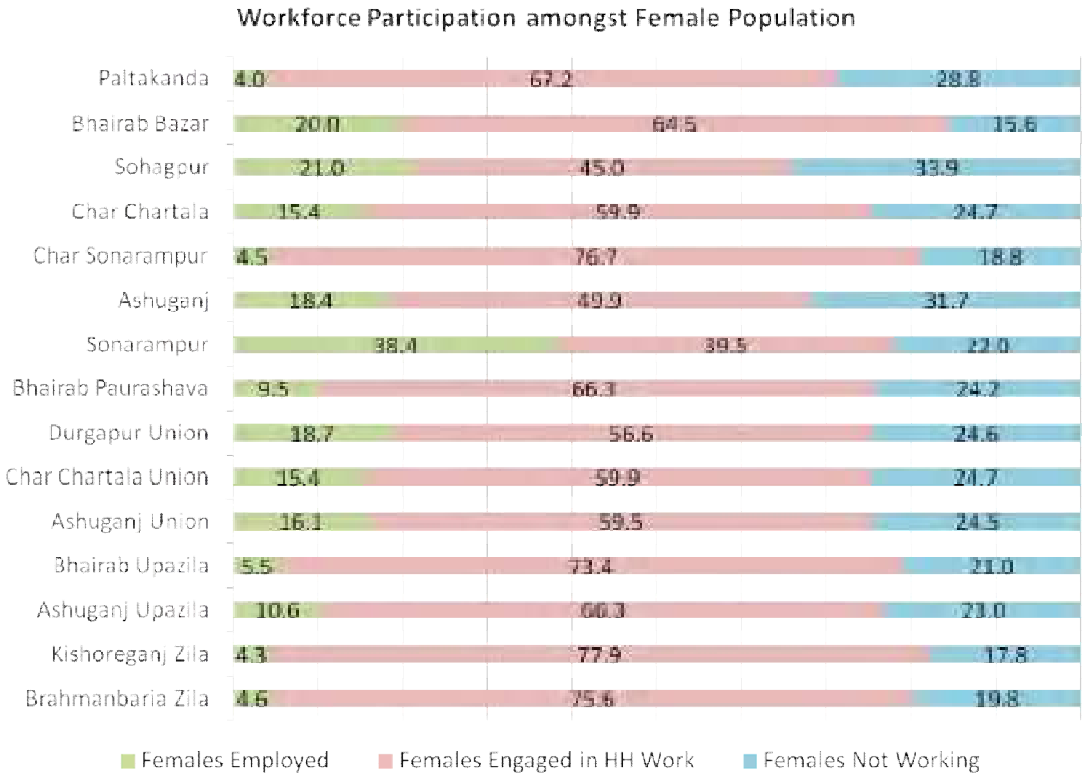


Figure 5-7: Workforce Participation amongst Female Population



Bangladesh's Agriculture Census, which was carried out in 2008, recorded the total number of agriculture labour households at 8.93 million. This figure accounts for 31.13% of the nation's total households, and of this only 0.27 % lies in urban areas. The Agriculture Census report states that the percentage of households drawing sustenance from agriculture is gradually decreasing.

While the districts of B. Baria and Kishoreganj have the major proportion of their population earning their livelihood through agriculture, most villages in the project influenced villages indicate otherwise, except Char Sonarampur.

The majority of Bhairab Bazaar's population (94.6) works in the service sector, followed by Ashuganj population (81 %). In Sonarampur, the workforce is mostly engaged in the industry sector (70.6). This fact was corroborated during the site visit, when during community consultations in Sonarampur, respondents reported that most educated persons work at the Ashuganj in either a technical, or semi skilled capacity. Details of the occupational pattern amongst the project influenced population have been provided in (Table 5-10).

Table 5-10: Details of Occupation Pattern amongst the Project Influenced Population

Sr. No	Administrative Unit	Field of Work		
		Agriculture	Industry	Service
1	Brahmanbaria Zila	68.3	7.1	24.5
2	Kishoreganj Zila	73.1	6.4	20.5
3	Ashuganj Upazila	32.4	21.7	45.9
4	Bhairab Upazila	36.3	18.7	45.0
5	Ashuganj Union	20.1	40.3	39.6
6	Char Chartala Union Total	28.6	6.3	65.1
7	Durgapur Union Total	18.8	32.2	49.0
8	Bhairab Paurashava	12.9	18.8	68.3
Villages				
1	Bhairab Bazar	2.3	3.1	94.6
2	Paltakanda	39.2	7.7	53.0
3	Sonarampur	5.4	70.6	23.9
4	Ashuganj	3.1	15.9	81.0
5	Char Sonarampur	71.5	5.3	23.2
6	Char Chartala	28.6	6.3	65.1
7	Shohagpur	14.5	45.4	40.0

The village of Char Sonarampur has been indicated as having a large proportion of population involved in agriculture (71.5 %). However, it may be noted, that the Bureau of Statistics classifies fishing, animal husbandry and aquaculture under the agricultural sector. During the site visit, it was observed that Char Sonarampur is completely inhabited by fishing communities, and the census estimates could well indicate that.

Findings from the Socio-Economic Survey and Consultations conducted regarding the Occupational Pattern

Fishing

The villages of Char Sonarampur and Paltakanda almost wholly draw livelihood from fishing and aquaculture. Paltakanda is a major fish market where the local fishermen sell fish to both local populace and traders, who then take it to Dhaka for the final sale. Fishermen made a monthly earning of anywhere between Bangladesh Taka (BDT) 10,000 - 35,000, depending upon the season and catch. Amongst the catch, prawn, "Hilsa" or "Ilish" and 'Rui' drew the best prices in the market.

The local fishermen practise a unique form of aquaculture, where in they accumulate the rampantly growing water hyacinth and bind it by tall bamboos erected in the river bed. Eventually fish and other aquatic life agglomerates there, breeds and grows in number. This type of culture is popularly known as Pulse fishing and provides a substantial catch for fishermen every couple of weeks.

Agriculture

Agriculture was reported to not being the main occupation, and was not being practised on large scale commercial basis. The villages of Shohagpur and Char Chartala were reported to grow and sell the maximum produce in the area. The crops commonly grown included at least three varieties of paddy (locally known as Aus, Amon and Baro), sweet potato, oil seeds like sesame, mustard and niger, gourds, brinjals, pulses (Moong and Mosur), tomatoes, carrots, radishes and a large variety of leafy vegetables and fruits.

Of these, the oil seed crops, brinjals and paddy were grown on a commercial basis to be sold off in Dhaka and adjoining areas. Most other produce was either used for personal consumption or sold in the local vegetable market.

Bamboo Trading

It was observed that Ashuganj village has a substantial and thriving bamboo business. The bamboo is brought to the village from Sylhet and Chittagong and sold to traders who sell it off in the rest of the country (most Dhaka). While the sellers and traders do not belong to the local population, the labour required to load and stack the bamboos on and off carriers is hired locally. It was reported that the bamboo labourers earn a daily wage of BDT 250 – 350 per day.

Rice Mills

Both Ashuganj and Bhairab Upazilas have several rice mills for at least a decade. Varied reports place the number of mills as 300 - 500. The mill owners transport locally and non locally grown rice to the mills where they boil, dry, de-husk, sift and package the rice before they transport it to other areas for the purpose of selling it.

Several rice mill workers were consulted and it was reported that most of them are migrants who belong to 'floating populations', who are illiterate, live in hay straw and tin roofed houses and have no access to basic amenities such as tap water, toilets, electricity. However, it was observed that

some of the rice mills had at least one sanitation facility, a hand pump and electricity connection in the common area. It was also observed that due to poor economic status the workers were unable to afford private medical services. The mill owners reported to providing the mill workers with emergency medical care and 1 – 2 kg rice per family/ day.

During consultations, it was reported that a male rice mill worker was paid at least 100 Taka a day and a female, 50 Taka for their labour, in compliance with the specified national Minimum wages. The Bangladesh Minimum Wages Board has not specified a minimum wage specifically for the Rice Husking Mill workers. However, the board specifies a minimum amount of 1,500 taka per month for all economic sectors which are not covered by industry-specific wages. By definition, this indicates the minimum wage for any unskilled work.

Small businesses

The Ashuganj Industrial Hub has grown substantially in the last 3 years. The growth has resulted in sprouting of several small businesses that provide services and goods to either the plants or the staffs. The businesses include housekeeping services, supply of canteen facilities, potable water, goods transportation, driver services, tea and snack stalls, laundry services, daily needs' stores and innumerable pharmacies.

Photo 1: Various Occupational Patten amongst the Population

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Workers at a Rice Mill, Sonarampur; Date: 21st April 2015</td><td>Pulse fishing being undertaken amongst the population in Paltakanda; Date: 21st April 2015</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Bamboo Trading near Ashuganj Bazaar; Date: 21st April 2015</td><td>Small Businesses and shops in Ashuganj Bazaar, Date: 21st April 2015</td></tr>
</table>

Migrant labour to other countries

It was reported that several young men from Ashuganj and Bhairab Upazilas are able migrate to other countries to work as unskilled and semi skilled labour. The preferred countries are the Saudi Arabia, Qatar and other Gulf countries.

5.3.11 Health Profile

Bangladesh's life expectancy at birth is 70.65 years with its world ranking in life expectancy being 150. When broken down by gender, it is 68.48 years for women and 72.31 for men.

According to the Country's Health and Morbidity Status Survey 2012, the maximum, infectious diseases cases in the country are recorded to be of fever (unknown origin), dysentery, diarrhoea, acute respiratory infection, skin diseases, conjunctivitis, hepatitis B, measles, influenza and urinary tract infections. Furthermore, morbidity caused by infectious diseases and nutritional deficiency, such as Measles, Dysentery, Goitre, Epilepsy, Rabies Chicken pox, Night blindness, Arthritis, Tuberculosis, Malaria and Kala-azar have been recorded to be the highest amongst the lowest socio – economical strata in Bangladesh.

The report also indicates that the maximum non communicable cases are recorded to be of heart disease, cataract, high blood pressure, stomach ulcer and asthma. These diseases have been recorded prevailing highest amongst populations within higher socio – economic strata.

Health indicators are not available for the smallest administrative unit – the village. However, upon consultations with a senior doctor at a prominent private hospital in Char Chartala, it was communicated that the most common ailments that the hospital saw as cases, were of fever (of unknown origin), urinary tract infections in both men and women, complications during child birth and dysentery.

In addition, during consultations with the local communities it came to light that water borne diseases were the most prevalent and the main cause of visits to Clinics and hospitals. When asked to provide an estimate number of times in a month one fell ill in their family, with fever and diarrhoea (two main symptoms of water borne diseases), the usual answer was "at least one case a month". The Bangladesh Bureau of Statistics enumerates disability status as part of its census surveys. The disability status for the project influenced area has been provided in (Table 5-11). As is evident, physical disabilities are the most common in the area, with 0.5 % of Bhairab Paurashva's population having some form of physical disability.

Table 5-11: Proportion Disabled Population in Project Influenced Area

S. No	Administrative Unit	% Population with at least one Disability	Type of disability (%)					
			Speech	Vision	Hearing	Physical	Mental	Autism
1	Brahmanbaria Zila	1.2	0.2	0.2	0.1	0.4	0.1	0.1
2	Kishoreganj Zila	1.6	0.2	0.3	0.2	0.6	0.2	0.1

S. No	Administrative Unit	% Population with at least one Disability	Type of disability (%)					
			Speech	Vision	Hearing	Physical	Mental	Autism
3	Ashuganj Upazila	1	0.2	0.1	0.1	0.4	0.1	0.1
4	Bhairab Upazila	1.3	0.2	0.3	0.1	0.5	0.1	0.1
5	Ashuganj Union	0.9	0.2	0.1	0.1	0.4	0.1	0.1
6	Char Chartala Union	1	0.2	0.1	0	0.3	0.2	0.1
7	Durgapur Union	1.2	0.2	0.2	0.1	0.4	0.2	0.1
8	Bhairab Paurashava	1.1	0.2	0.2	0.1	0.5	0.2	0

5.3.12 Access to Essential Services

Housing and Residence

One way of gauging economic status of the population is through assessing land holdings and ownership status of dwellings. Landless households may be considered as those households who do not own any land of their own, whether homestead or agricultural. The Agricultural Census report describes tenant households as those which pay rent (either in cash or in kind) to use or use others' land for cultivation and other related activities.

The Bangladesh Agriculture Census of 2008 revealed that the country was home to over 4.48 million landless households of which 1.22 million were in urban areas and 3.26 million in rural areas. The report further states that the percent of landless households is steadily increasing in rural areas. Dhaka Division has the highest percentage (20.32%) of landless households, both in rural as well as urban areas.

As evident in (Table 5-12) majority of the households live in self – owned houses and are not bound financially towards rent payments. The only exception is that of Ashuganj Village, where 82.5% of persons live in rented houses. This is probably due to the high number of migrant workers who live locally and work at the Ashuganj Hub.

Table 5-12: Proportion of Housing and Tenancy in Project Influenced Area

S. No	Administrative Unit	Housing Tenancy (%)		
		Owned	Rented	Rent free
1	Brahmanbaria Zila	91.5	5.9	2.5
2	Kishoreganj Zila	93	4.4	2.6
3	Ashuganj Upazila	80.2	13.2	6.6
4	Bhairab Upazila	80.9	16.2	2.9
5	Ashuganj Union	60.1	29.9	10
6	Char Chartala Union	50.4	41.6	8
7	Durgapur Union	85.5	1.3	13.2
8	Bhairab Paurashava	58.3	38.1	3.6
Villages				
1	Sonarampur	25.7	52.7	21.6
2	Ashuganj	13.9	82.5	3.6
3	Char Sonarampur	85.2	4.1	10.7
4	Char Chartala	50.4	41.6	8
5	Shohagpur	84.2	3.1	12.7

S. No	Administrative Unit	Housing Tenancy (%)		
		Owned	Rented	Rent free
6	Bhairab Bazar	21.8	76.2	2
7	Paltakanda	62.2	34.2	3.6

Table 5-13 provides an overview of the type of houses and the proportion of population living in them. Most residents live in semi pucca (semi solid) and kuccha (mud house) house in the area, with the exception of Char Sonarampur. Close to 89% of the Char Sonarampur village's population lives in Kuccha houses. Consultations revealed a two-fold reason for this, first, because the community is extremely poor, and second, because they often have to rebuild their houses if and when the River Meghna floods the small island, that is home to their community.

Table 5-13: Type of Housing Structure in Project Influenced Area

S. No	Administrative Unit	Type of Housing Structure (%)			
		Pucca	*Semi pucca*	*Kuccha*	*Jhupri*
1	Brahmanbaria Zila	8.2	13.7	77	1.1
2	Kishoreganj Zila	2.8	11.5	84	1.6
3	Ashuganj Upazila	13.3	19.4	67.1	0.3
4	Bhairab Upazila	9.6	16.9	72.6	0.8
5	Ashuganj Union	20.6	21.6	57.4	0.4
6	Char Chartala Union	32.6	31.1	36.2	0.1
7	Durgapur Union	4.7	15.2	79.8	0.3
8	Bhairab Paurashava	20.2	30.1	49.3	0.3
Villages					
1	Sonarampur	38.4	28.1	33.4	0.1
2	Ashuganj	41	27.9	29.5	1.6
3	Char Sonarampur	0	9.7	89.3	1
4	Char Chartala	32.6	31.1	36.2	0.1
5	Shohagpur	7.9	22.7	69.5	0
6	Bhairab Bazar	67.2	11.2	21.1	0.6
7	Paltakanda	9.4	8.7	81.9	0

Water

The majority of Bangladesh's population sources its drinking water through tube wells, despite having high levels of arsenic and iron contents in the water.

The project influenced villages reflect this trend and utilise ground water the most for human consumption. During consultation, all respondents reported to drinking the ground water despite the water being 'red'. However, they all reported that their respective villages as '*not*' having arsenic contents in the ground water. Details of drinking water source in the project influenced areas have been provided in (Table 5-14).

Table 5-14: Drinking Water Source in Project Influenced Area

S. No	Administrative Unit	% Population with following Source of Drinking Water		
		Tap	Tube Well	Other
1	Brahmanbaria Zila	2.2	93.9	3.9
2	Kishoreganj Zila	1.1	94.1	4.8
3	Ashuganj Upazila	8	90.5	1.5

S. No	Administrative Unit	% Population with following Source of Drinking Water		
		Tap	Tube Well	Other
4	Bhairab Upazila	3.2	94.7	2.1
5	Ashuganj Union	12.9	85.2	1.9
6	Char Chartala Union	33.4	64.7	1.8
7	Durgapur Union	0.9	97.5	1.6
8	Bhairab Paurashava	7.5	91.8	0.7
Villages				
1	Sonarampur	17.7	82.1	0.2
2	Ashuganj	40.4	59	0.7
3	Char Sonarampur	0	100	0
4	Char Chartala	33.4	64.7	1.8
5	Shohagpur	2.2	97.7	0.1
6	Bhairab Bazar	13.2	86.6	0.2
7	Paltakanda	2.3	97.7	0

Sanitation

Most houses in rural areas within the project influenced region have either Sanitary (non water sealed) toilets or non sanitary toilets. The more urban areas, such as Ashuganj and Bhairab Bazar have higher proportion of number of water sealed and non water sealed toilets than non sanitary ones. Details of sanitary facilities in the project influenced areas have been provided in (Table 5-15).

Table 5-15 : Details of Sanitary Facilities available in Project Influenced Areas

S. No	Administrative Unit	Proportion of Population with following type of Toilet Facility			
		Sanitary (water- sealed)	Sanitary (non water-sealed)	Non sanitary	None
1	Brahmanbaria Zila	21.2	48.9	26.6	3.2
2	Kishoreganj Zila	12.9	32	44.7	10.5
3	Ashuganj Upazila	35.1	55.2	7.8	1.9
4	Bhairab Upazila	20.4	34.6	37.4	7.6
5	Ashuganj Union	48.9	40.6	8.5	1.9
6	Char Chartala Union	29.5	64.8	3.9	1.8
7	Durgapur Union	28.2	62.1	8	1.7
8	Bhairab Paurashava	38.7	37.9	19.7	3.8
Villages					
1	Sonarampur	53.1	33.4	13	0.5
2	Ashuganj	65.4	29	5.5	0.1
3	Char Sonarampur	1.4	66.9	16.6	15.2
4	Char Chartala	29.5	64.8	3.9	1.8
5	Shohagpur	40.2	49.9	9.8	0.1
6	Bhairab Bazar	72.8	23.2	3.6	0.4
7	Paltakanda	18.5	36.4	35	10.1

Electricity Connectivity

There is regular supply of electricity in the project influenced area, with the sole exception of Char Sonarampur. This point was ascertained during consultations with community members of Char

Sonarampur. As is evident in the (Table 5-16) a very high proportion of villages have constant supply of electricity.

Table 5-16: Details of electricity connection amongst HH in Project Influenced Area

S. No	Administrative Unit	Proportion of HH with Electricity Connection
1	Brahmanbaria Zila	71.3
2	Kishoreganj Zila	49.6
3	Ashuganj Upazila	91.2
4	Bhairab Upazila	86
5	Ashuganj Union	92.8
6	Char Chartala Union	98.4
7	Durgapur Union	94.8
8	Bhairab Paurashava	97
Villages		
1	Sonarampur	99.5
2	Ashuganj	96.7
3	Char Sonarampur	2.8
4	Char Chartala	98.4
5	Shohagpur	99.3
6	Bhairab Bazar	95.8
7	Paltakanda	98.6

Health Care Services

The Ashuganj Upazilla has 1 Upazilla health complex, 2 union sub-centres, 5 family welfare centres and 9 community clinics. The Bhairab Upazilla has 1 Upazilla health complex, 5 family welfare centres, 2 union sub-centres and a railways hospital. During stakeholder consultations, however, it was observed that most residents have little faith in the government run facilities and prefer to go to private clinics and hospitals in the vicinity.

The Day Night Hospital, located in Char Chartola is one such hospital which caters to the need of residents from even across the river – Bhairab bazaar and Paltakanda. The hospital is the only one in a 5 km radius which as emergency services including ambulances. Since the hospital minimizes the fee for the socio economically weak families, even the poor such as the rice mill workers prefer to seek consultation from the hospital as much as possible.

The stakeholders reported that the government health care workers visit each village at least once a fortnight to provide family planning services, child immunization and ante natal care services for pregnant women. The government run Shobut Chhata (Green Umbrella) campaign for family planning is seen visible in several villages, with stakeholders from Paltakanda, Shohagpur, Sonarampur and Char Chartala specifically mentioning the services.

Transportation

Both the Upazilas are well connected by roadways, waterways and railways. There is a bridge that connects the two Upazilas, and therefore the two districts of B. Baria and Kishoreganj, provides easy access to either of the two divisions. The Ashuganj village has an important and well networked riverine port with a jetty and options for docking several boats at once. In addition, the roads

connecting the villages are pucca, and observed to be in fair condition. Both Upazilas have a railways station each, thus providing the farmers and rice traders' good options to commute to other districts for selling their produce.

Education Facilities

According to Bangladesh's Local Government Engineering Department Statistics, Ashuganj Upazilla has 4 colleges, 14 secondary schools, 46 primary schools 46, and 4 Madrassas. Bhairab Upazilla has 5 colleges, 15 high schools, 6 Madrassas, 58 primary schools, 17 middle schools, one government vocational training centre and 2 social welfare training centres.

In close vicinity to the UAEL project site, there are 2 primary schools and 4 middle – senior schools, all of which are functioning and fully staffed. All the project influenced villages have at least one primary school each, although Char Sonarampur's school is devoid of any furniture and lacks trained teachers.

With the exception of Char Sonarampur, all villages have at least one middle school within their vicinity, and senior schools within a 2 km radius. Students wishing to continue their education go to the colleges in Ashuganj Bhairab Upazilas – The Firoz Miah University College and the Bangabandhu Polytechnic and Commerce College. Other than these, there are several privately run schools in Ashuganj and Bhairab Bazar.

Banking

The nearest banking services for the villages that fall under Ashuganj Upazilla are in Ashuganj Bazaar area. It was reported during community consultations that there are a total of 20 banks, of which 6 are government owned. All the banks have ATM machines for easy access to cash. On the other side of the river, Paltakanda and Bhairab Bazar have easy access to several banks in Bhairab Bazaar.

There are several micro finance institutions that provide banking services, in addition to low – interest loans. These are the Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, Association for Social Advancement (ASA), Ashar Alo Mohila Unnayan Sangstha, and Panjeri Samaj Unnayan Sangstha (PASUS).

5.4 Stakeholder Analysis, Consultation and Public Awareness

Stakeholder consultations are important processes through which a two way dialogue is created between the project proponents and the stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. They can comprise of individuals, communities, social groups, organizations etc. As per World Bank's Policy on Disclosure of Information, 2002 participation of pubic is necessary as it is a two way process wherein people learn about and have input into design of projects that affect their lives, well-being and environment.

By identifying and consulting all stakeholders, especially the poor and the vulnerable, it is essential to ensure that the project meets the need of all sections of the people. Stakeholder engagement is a continuous and inclusive process between a project proponent and those potentially impacted encompassing various activities and interactions over the entire life of the project.

5.4.1 Stakeholder Identification

The stakeholders in the project were identified based on their level of interest and influence over the project activities. The stakeholders were primarily divided into direct and indirect and further regrouped as internal and external. In Table 5-17, the types of stakeholders as per their level of interest and influence have been provided.

Table 5-17: Types of Stakeholders as per their interest and influence

S. No.	Types of Stakeholders	Groups + Individuals
1	Direct Internal Stakeholders	• United Ashuganj Energy Limited (UAEL) • United Engineering and Power Services Limited (UEPSL)(O&M Contractor) • Ashuganj Power Station Company Limited • Direct Employees of UECL & UAEL (present and future)
2	Direct External Stakeholders	• Power Division, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh • Bangladesh Power Development Board • Bakhrabad Gas Distribution Company Limited • Department of Environment (DOE) • Current/ Future Contractors • Financial Intermediaries
3	Indirect Internal Stakeholders	Families of Direct Employees
4	Indirect External Stakeholders	• Local Communities in adjoining areas like Sonarampur, Ashuganj, Char Chartola & Shohagpur villages • Local Government (Member of Sonarampur, Ashuganj, Char Chartola & Shohagpur villages and Chairman and members of Ashuganj Union Parishad) • Opinion Leaders of Sonarampur, Ashuganj Bazaar, Char Chartala & Shohagpur villages • Bangladesh Forest Department, Brahmanbaria (specific) • Department of Fisheries, Brahmanbaria • Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, Association for Social Advancement (ASA), Ashar Alo Mohila Unnayan Sangstha, Panjeri Samaj Unnayan Sangstha (PASUS), Satodal Samaj Kallyan Sangha (SSKS), PROSHIKA (NGOs) • Local Media • Vendors

The description of each stakeholders and their grouping into the various types have been provided below:

Direct Internal Stakeholders: Direct internal stakeholders comprise the parent company or the project proponent and the employees of the company that are directly controlled by the parent company. Direct internal stakeholders comprise of the following group/individual and entities:

- *United Ashuganj Energy Limited (UAEL):* UAEL having 71% share in the project is the primary stakeholder. UAEL is obligated to adhere to World Bank Group standards as it is bound to undertake the project in a manner that upholds its commitments to identify and mitigate all associated environmental and social risks for all its project activities.
- *United Engineering and Power Services Limited (UEPSL)*: UEPSL being the Operation and Maintenance Contractor of UAEL is also a main stakeholder of the project. UEPSL is also obligated to adhere to international standards like World Bank and IFC Performance Standards as it is bound to implement all the mitigation measures for environmental and social risks for all the project activities.
- *Ashuganj Power Station Company Limited (APSCL)*: APSCL with 29% share of the project is also the primary stakeholder according to the Share Purchase Agreement dated 27th October 2013. APSCL and UAEL as partners in this private public partnership are equally responsible for adhering to both international and national standards in assessing and identifying environmental and social risks and adopting adequate mitigation measures to eliminate the risks associated with this project. In addition, the total land required for the project amounting to 6.48 acres has been leased by APSCL to UAEL as per the land lease agreement dated 27th October, 2013. A copy of the land lease agreement has been *attached as Annexure VIII.*
- *Direct Employees*: At present, due to the sphere of activities being undertaken at the project site, a total of 200-220 employees are currently employed with 25 workers from Brahmanbaria District. Once the project becomes operational, it is envisaged that approximately 150 workers will be engaged in the project. The employees being direct stakeholders, their feedback is essential to foster and maintain the worker management relationship.

Direct External Stakeholders: Direct external stakeholders comprise the external bodies that have direct stake in the project like Power Division, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, Bangladesh Power Development Board, Bakhrabad Gas Distribution Company Limited, third party contractors and financial intermediary. These stakeholders directly affect the project activities and are not controlled by the project proponent.

- *Power Division, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh:* Through the Implementation Agreement dated 27th October 2013 between the Power Division, Ministry of Power, Energy and Mineral Resources and UAEL, UAEL will be required to pay incentives and concessions to the Power Division, thus, making it one of the key stakeholders.
- *Bangladesh Power Development Board (BPDB):* Through the Power Purchase Agreement dated 27th October 2013 between UAEL and BPDB, UAEL will sell the power generated through the project to BPDB for a period of 15 years, hence, making it a key stakeholder.
- *Bakhrabad Gas Distribution Company Limited (BGDCL):* Through the Gas Supply Agreement dated 19th February 2014 between UAEL and BGDCL, BGDCL will supply gas to UAEL for the project for a period as mentioned in the Power Purchase Agreement.

- *Department of Environment (DOE):* An Environmental Clearance Certificate from Department of Environment (DoE) DOE Memo No. Paribesh/ Bra JeA/Clearance – 538/2013/73; dated 2nd April 2015 has been obtained by the Company. UAEL and its project proponent UECL is bound to comply with the conditions mentioned in the Environmental Clearance. The external reporting made to DOE (in case of any changes) and its observations will guide the implementation of the project activities.
- *Financial Intermediaries:* The financial intermediaries comprise of financial institutions, in this case Dhaka Bank Limited under World Bank supported Investment Promotion and Financing Facility, IFC, SCB and DEG who are undertaking the project financing. This stakeholder tends to be influential and have a set of guidelines, which UAEL would need to comply. UAEL will also have to comply with various undertakings made to the financial institution besides the set guidelines.
- *Contractors/ Sub-contractors:* As both the Contractors and third party contractors would be engaged in the different phases of the project activities, they would be considered as stakeholders as well.

Indirect Internal Stakeholder: Indirect internal stakeholders consist of the secondary stakeholders who would have a more indirect interest but within the direct influence of the project.

- *Families of Direct Employees:* Families of direct employees (present and future) comprise the indirect internal stakeholder. This group would be indirectly affected by the decision of the project proponents if promotion or retrenchment of their family members directly employed in the operational facilities is undertaken.

Indirect External Stakeholder: Indirect external stakeholders comprise those stakeholders whose interest even though are indirect they fall within the external group such as those involved in institutions or agencies concerned with managing the resource or those who depend at least partially on the business generated by the resource.

- *Local Community in adjoining villages:* The development of the project will add to the increase of vehicle movement and influx of workers from other areas which will in turn, impact the local community to a considerable extent. Constant consultation and disclosure of information about the project activities need to be communicated to the local community so that transparency and support about the activities can be maintained with the local population.
- *Opinion Leaders of adjoining villages:* Opinion leaders like ex-members of Sonarampur, Ashuganj Bazaar, Char Chartala and Shohagpur villages, primary and high school teachers, health officials and religious leaders of the local Mosque(s) fall within the category of opinion leaders. Being residents of adjoining villages situated within the vicinity of the project site area, their opinions are valuable regarding the impacts and mitigation measures that would be applied to the different phases of the project.
- *Local Government (Member of Sonarampur, Ashuganj, Char Chartola and Shohagpur villages Chairman and members of Ashuganj Union Parishad):* The government at the local level comprising the present member of Sonarampur, Ashuganj Bazaar, Char Chartala and Shohagpur villages and Chairman and members of Ashuganj Union Parishad will be responsible to play an active role pertaining to the collection of grievances regarding issues that might arise from the project activities. They will be responsible to act as the communication channel between the

local area and the project proponent. They are considered as indirect stakeholders as they do not have a day to day role in the project development but will play a significant role in monitoring that the resolution of project level issues by UAEL is carried out in a transparent manner.

- *Bangladesh Forest Department, Brahmanbaria (specific):* The Forest Department working in the Brahmanbaria area have focused their attention on social forestry patches which is carried on revenue land owned by the Government. The Social Forestry Program imbibing the elements of participatory approach engages the local community in looking after the identified forest patches. The objective of the social forestry program is to meet the local needs for fuel wood, small timber, bamboo, fodder and other minor forest produces on sustained basis, provide employment opportunities to the rural population, develop cottage industries in rural areas, utilize the available land to the best advantage according to its production capacity, provide efficient soil and water conservation and improve aesthetic value of the area and to meet the recreational needs of the population. Even though no forest land was acquired by the project proponent, their role as an indirect external stakeholder is significant as due to their active monitoring in the area, any change (minor or major) in the flora and fauna conditions around the power hub can be easily detected by them.
- *Department of Fisheries, Brahmanbaria:* The discharge water from open circuit water circulation unit will be discharged into the Meghna River. Even though not much difference in the water temperature is anticipated which will cause any potential significant impact, the department of fisheries based at Brahmanbaria can play a significant role as an indirect external stakeholder. Being a monitoring agency actively working in the area because of the existing fishing activities, the department can be one of the first agencies to detect a change in the water temperature and its effect on the local population.
- *Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, Association for Social Advancement (ASA), Ashar Alo Mohila Unnayan Sangstha, Panjeri Samaj Unnayan Sangstha (PASUS), Satodal Samaj Kallyan Sangha (SSKS), PROSHIKA (NGOs)*: NGOs practicing in the local communities around the project area can play an important role in collaborating with UAEL for future welfare activities of the local communities.
- *Local Media*: Media groups that have covered the public hearing of the facilities are active and can be brought within the gamut of external stakeholder. In future, these media groups can be updated on the development of the project activities and publicise any subsidiary developments that the project proponent will undertake for the local communities residing within the vicinity of the project area.
- *Vendors:* The vendors that will be engaged in the operational phase of the project will form a significant part of the project activities. The vendors will fall within the category of indirect external stakeholder as the crux of their function is to source raw material for the project.

5.4.2 Stakeholder Analyses

Stakeholder analysis takes a more comprehensive view of the stakeholder's group interests, how they would be affected and to what extent and influence they could have on the project. These aspects cumulatively provide the basis for constructing the stakeholder engagement strategy. Once different types of stakeholders have been identified and listed, matrices and other illustrative devices can be developed that map the nature of the stakeholders interest in the project, the extent

to which stakeholder interests converge or overlap, their importance in the different phases of the project activities and their influence over the project (as depicted in the power/interest grid).

The key stakeholders identified in the above section have been categorised into four major groups: Government Agencies, Positively Influenced Stakeholders, Critical to Engage and Donors. The categorisation list of key stakeholders has been provided in the following (Table 5-18),

Table 5-18 : Categorization List of Key Stakeholders

Categorisation	Key Stakeholders
Government Agencies	• Ashuganj Power Station Company Limited • Bangladesh Power Development Board • Power Division, Ministry of Power, Energy & Mineral Resources, Government of Bangladesh • Bakhrabad Gas Distribution Company Limited • Department of Environment • Bangladesh Forest Department, Brahmanbaria (specific) • Department of Fisheries, Brahmanbaria
Positively Influenced Stakeholders	• Local Communities in adjoining areas like Sonarampur, Ashuganj Bazaar, Char Chartala & Shohagpur villages • Direct Employees of UAEL & UEPSL (present and future) • Families of Direct Employees • Future Contractors • Vendors
Critical to Engage	• Local Government (Member of Sonarampur, Ashuganj Bazaar, Char Chartala & Shohagpur villages and Chairman and members of Ashuganj Union Parishad) • Opinion Leaders of Sonarampur, Ashuganj, Char Chartola & Shohagpur villages • Local Media • Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, Association for Social Advancement (ASA), Ashar Alo Mohila Unnayan Sangstha, Panjeri Samaj Unnayan Sangstha (PASUS), Satodal Samaj Kallyan Sangha (SSKS) (NGOs)
Lenders	• Financial Intermediaries (World Bank, IFC, SCB & DEG)

In order to map the interest of the stakeholders on the project activities, a matrix showcasing the stakeholders and their interest has been developed. This step is to assess the interest/influence into high, medium and low as well as to assess the power relationship, impact, support and attitude of the various identified stakeholders. In Table 5-19, the interest matrix has been provided.

Table 5-19 : Interest Matrix of Stakeholders

Categorisation	Key Stakeholders	Influence: Power to facilitate or impede project	Importance: Degree of priority needs and interests	Interest Level
Government Agencies	Ashuganj Power Station Company Limited	High	High	High
	Bangladesh Power Development Board	High	High	High
	Power Division, Ministry of Power, Energy & Mineral Resources, Government of Bangladesh	High	High	High
	Department of Environment	High	High	High

Categorisation	Key Stakeholders	Influence: Power to facilitate or impede project	Importance: Degree of priority needs and interests	Interest Level
	Bakhrabad Gas Distribution Company Limited	High	High	High
	Bangladesh Forest Department, Brahmanbaria (specific)	Low	Low	Low
	Department of Fisheries, Brahmanbaria	Low	Low	Low
Positively Influenced Stakeholders	Local Communities in adjoining areas like Sonarampur, Ashuganj, Char Chartola & Shohagpur villages	Low	Medium	High
	Direct Employees of UAEL & UEPSL (present and future)	Low	Medium	High
	Families of Direct Employees	Low	Medium	High
	Future Contractors	Low	High	High
	Vendors	Low	High	High
Critical to Engage	Local Government (Member of Sonarampur, Ashuganj Bazaar, Char Chartala & Shohagpur villages and Chairman and members of Ashuganj Union Parishad)	Medium	Low	Medium
	Opinion Leaders of Sonarampur, Ashuganj Bazaar, Char Chartala & Shohagpur villages	Medium	Low	Medium
	Local Media	Medium	Low	Medium
	Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, Association for Social Advancement (ASA), Ashar Alo Mohila Unnayan Sangstha, Panjeri Samaj Unnayan Sangstha (PASUS), Satodal Samaj Kallyan Sangha (SSKS), PROSHIKA (NGOs)	Medium	Low	Medium
Lenders	Financial Intermediaries (World Bank, IFC, SCB, DEG)	High	High	High

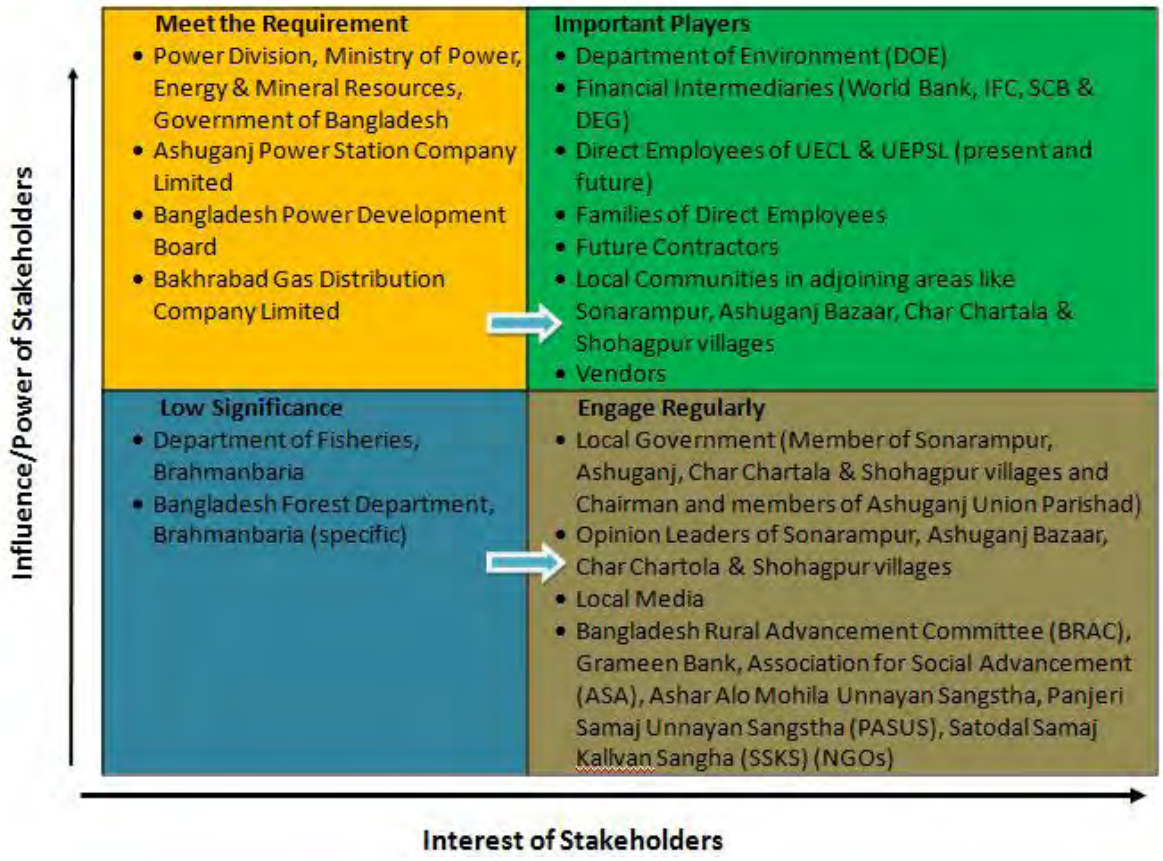
Source: Adapted from World Bank (2003b)

Having contemplated the stakeholders in terms of their interest matrix, the next step is to map the stakeholders by mapping them as per their interest and power as determined by the matrix. By using a power/interest grid, each stakeholder have been categorized in either of the four sections of meeting the requirement, important player, low significance and engage regularly. The Figure 5-8 highlights the power/interest grid of the stakeholders identified.

As per the power/interest grid, the stakeholders which have a high interest in the project due to opportunities, benefits and risks involved have been categorised in the section of important players. The stakeholders which have a medium to high interest in the project has been categorised in the section of meeting the requirement while the stakeholder which has low interest has been categorised in the low significance section. Those stakeholders wherein communication has to be regular has been categorised in the engage regularly section. Given ample amount of time during the different phases of the project cycle, the stakeholders who are in the meet the requirement section can be important players. Similarly, the stakeholder in the low significance can be shifted to the

engage regularly section by the project proponent if a proper plan of stakeholder engagement and consultation is duly developed and implemented.

Figure 5-8: Power/Interest Grid of Stakeholders Identified



5.4.3 Project Influenced Area: Public Consultations by AECOM

Consultations were held with various stakeholders during the site visit by the Aecom Experts The stakeholders comprised of representative of local community, NGOs working in the area, opinion leaders and local government officials. The details of the consultations held with various stakeholders have been provided in the following:

Views of Ms. Jyotsna Choudhary, representative of Ashar Alo Mohila Unnayan Sangstha (Non Governmental Organization)

Ashar Alo Mohila Unnayan Sangstha is one of the registered NGO which has been working within the Ashuganj Upazila for the upliftment of the people. The NGO has been working for approximately six (6) years in the area. The main focus area of its work has been in providing micro finance to poor families, support poverty ridden families through distribution of clothes, create awareness against domestic violence and providing shelter to victims of domestic abuse, generating awareness against underage girls getting married and providing trainings to women in the rearing of goats, poultry, sewing, agricultural work etc.

On enquiring about the issues and concerns prevalent in the area, it was reported that early marriage of girls and poverty were the most significant. Due to the early marriage of girls who are underage, health issues at the time of child birth is prominent in the area. To combat poverty, the Organisation has been providing loans to poor families by charging a nominal interest rate of 5 % from the borrowers. A total of 200-300 individuals till date have taken loans from the organisation with 60% of them being women. Other areas of concern are insufficient job opportunities in the area despite good education system prevalent, lack of medicines in health care facilities and poor conditions of existing health care facilities.

Views of Ms. Rumana Begum, representative of Araishidha Gono Gobeshona Mohila Shomoboy (Non Governmental Organisation)

Araishidha Gono Gobeshona Mohila Shomoboy is an unregistered NGO which has been working within Araisidha Union Parishad for the welfare of the poorer section of the society. The NGO has been working for approximately six (6) to seven (7) years in the area. The main area of concentration of its work lies in micro finance, support to poverty ridden families, creating awareness on maternal health and providing training on aspects like sewing, driving and computer etc. to poor and underprivileged population of the area.

The main issues and concerns prevalent in the area as discussed with the representative suggested that most of the poor people even though take up various training courses to broaden their skills however, due to lack of resources at their disposal, they fail to covert these training sessions into career prospects. The loans provided by the organisation are interest free and here too, women are the main borrowers. The organisation also lends its support to the local population by providing free services in applying of passports and visa applications.

Views of Mr. Sandip Kumar Singho, Upazila Nirbahi Officer, Ashuganj Upazila

Mr. Sandip Kumar Singho is the Upazila Nirbahi Officer of Ashuganj Upazila. According to his views, the main benefits that have emerged in the area with the coming up of the power hub in Ashuganj is the increase of employment opportunities for the local population. The spurt of technical skill set required for the power projects in the area have led to the in-flow of technical people which have led to an increase of diversity amongst the people. This has also attributed to the change in local people's attitude towards these people because of their interaction with them.

Due to the nature of the power project, no environmental hazards are envisaged in the surrounding area. The main area of concern however, is related to the migrant labourers of rice mills coming to the area and creating social problems amongst the local population. Another issue is related to vested interest groups regarding supply of semi skilled and unskilled labour in the area, thus creating unhealthy conditions in the area.

In terms of grievances of local population regarding the power projects in the area, it was reported that in any projects in the initial period, labour force problems usually emerge. This stems from the fact that the local population expects employment opportunities to increase with the coming of power plants in the area. However, as technical skill sets are required for the power plants, people with these skills sets are given priority instead of the local population which lacks these skills. Hence,

conflicts generally arise between the locals and the project proponents regarding expectations of the local population. In terms of development in the area, infrastructure is one area which needs to be given utmost priority. Moreover, adequate houses and accommodations are required to be developed in order to cater to the outsiders coming to the area. Inter connectivity of roads connecting the power hub with other areas needs to also be improved as at the moment development is concentrated only around the power plants.

In conclusion, it was stated that the local population in general have benefitted from the power plants in the area and they are positive of the developments that are taking place which have been triggered by the power plants.

Views of Mr. Giasuddin Ahmed, Alam Nagar, member of Ashuganj Upazila

Mr. Giasuddin Ahmed stated that employment opportunities have increased with the coming of power projects in the area. Opportunities like technicians and construction labourers have grown in the area. The availability of electricity has become more widespread. Interactions between the outsiders and the locals have also increased thus bringing about a change in the attitude of the local population.

Till date no local people have come forward to raise any complaints regarding the power plant. However, substantial noise pollution and increase of heat in the area have been observed to emerge from the AGGREKO power plant in the area.

The main expectations of the local population in the area are that there is no proper playground for the locals in the area and secondly, the girl school in the area should be upgraded to the college level.

Views of Mr. Ayub Khan, Chairman, Char Chartala Union Parishad

Mr. Ayub Khan while giving an overview of the Char Chartala Union Parishad stated that the Union comprised of two main villages, namely, Char Chartala and Maharampara. Both the villages cumulatively comprise of total population of 25000 people. The average family size consists of four to five members. There are no ethnic group in the area. A total of 98% of the population follow Islam while 2% follow Hinduism. The main occupation of the population in Char Chartala comprise of traders, technicians and agriculturalist.

The prior land use of the project area before the land was transferred by the APSCL to UAEL comprised of a ditch were people occasionally took up fishing activities and patches were agricultural activities used to be carried upon.

The main benefits that the local population have received with the coming up of the power plant is related to an increase in employment opportunities, rise in skilled and technical population in the area, availability of reliable and quality electricity and industrialisation in terms of business boom in adjoining areas.

Till date, no local population have approached him regarding any concerns or grievances about the power plants in the area.

In terms of development in the area, focus needs to be given in the field of education, infrastructure and communication facilities.

Views of Md. Rohul Amin, Panel Chairman, Durgapur Union Parishad, Ashuganj

Md. Rohul Amin in providing an overview of Union Parishad stated that six (6) villages come under the Union, namely, Shohagpur, Bahadurpur, Durgapur, Tazpur, Khariala and Bogair. The total approximate population of Shohagpur comprises of 12,500 people wherein males consist of 52% and females make up 48 % of the population respectively.

The main Government Schemes prevalent in Shohagpur relates to allowances in terms of old age, poor people education, continuation of education for new mothers and freedom fighters.

Three main NGOs work in the area namely, ASA, BRAC and Panjiri whose main area of work is providing loans to the poorer section of the society.

The land prior to the power plant development consisted of a ditch were fishing activities used to take place.

There were no grievances from the local population regarding the UAEL plant however the locals are concerned about the noise generated by the power plants cumulatively in the area.

The main issues raised by the Panel Chairman were in regards to employment opportunities which need to increase for the local population. Infrastructure development in terms of roads, bridges, schools and communication system is required in the area.

As part of the Corporate Social Responsibility that the UAEL might take up in the future, it was suggested that a primary school, Shohagpur North Primary School is required to be developed in Shohagpur village.

Views of Mr. Saliuddin, Ex-Chairman, Ashuganj Union Parishad

Mr. Saliuddin in his views stated that the land use of the area prior to the development of the power plant comprised of a ditch with limited economic activities. With the coming up of the power plant, employment opportunities for the local population have increased in terms of boom in business activities. Availability of electricity has also increased in the area.

No grievances from the local population have come forth till date regarding the power plant.

In terms of development, the main priority needs to be given in the field of education, improvement of local roads and improvement of health facilities in the area.

Views of Mr. Illias Ali, Head of Char Sonarampur Village

Mr. Illias Ali while providing an overview of Char Sonarampur village stated that the island comprises of approximately 500-600 resident families wherein 80% of the population follow Hinduism and 20% follow Islam.

The population is largely engaged in fishing activities. The major problems in the village can be attributed mostly in terms to lack of electricity supply, availability of gas facilities for cooking and transportation problems. The population are extremely poor and have low standard of living.

A primary school exist on the island however, amenities in the school are not sufficient. There is a lack of tables and benches in the school and during the monsoons the school gets inundated with the floods. A total of only 10% of the population get an opportunity to pursue education in any form. Due to extreme poverty amongst the families in the village, most parents opt for their wards to take up work instead of being enrolled in schools. Approximately 5% of the population are engaged as daily wage labourers thus earning, 350-400 Taka/day.

A persistent problem in the area relates to the local people opting to take loans from private companies or individuals. Approximately 200-300 families have taken loans from this source. The option of choosing private players instead of NGOs is because the loan sharks do not demand any paperwork or document as compared to NGOs.

Vocational training centres need to be developed in the area but before this step is initiated, the awareness and importance of these centres and the benefits that will be incurred need to be provided to the local population.

Views of Mr. Shahidullah Pradhan, relative of Sonarampur Village Head

Mr. Shahidullah stated that Sonarampur Village has a total population of approximate 2000 people with 95% of the population following Islam while 5% following Hinduism. Around 20% of the population have migrated to the Middle East and are employed there. They currently send remittances to their family members residing in the area. 40% of the population are engaged as shop owners and small traders while the remaining population and engaged as agricultural labourers and labourers in rice mills. The agricultural labourers receive wages amounting to 300 Taka /day while the labourers in Rice mill earn 80-90 Taka/day.

The main NGOs working in the area are ASA, BRAC and Grameen Bank, all engaged in the facility of providing micro finance to the local population in the area.

The village has a Primary Health Centre wherein a health worker comes every week and provides services related to Ante Natal Check up, family planning and vaccination to the local population of the area.

The benefits that the local population have received from the project relates to expansion of business activities, better facilities in terms of railways and boat network which has indirectly

increased the bamboo business in the area, improvement of hospitals, schools and increase of employment opportunities.

The negative impact of the project activities relates to undue pressure on the local resources and sanitation facilities. In addition, prices of goods have also gone up which have affected the lower income group of the resident population.

Views of Dr. Suman Sarkar, MBBS & MD (Nephrology), Day and Night Hospital, Char Chartala Village

Dr. Suman Sarkar is currently practicing as a medical doctor in Day and Night Hospital which is private owned.

The positive aspects on the health of the local population after coming up of the power plant hub as observed through his practice has been in terms of improved nutritional intake of the people and fall in maternal deaths.

The negative aspects relate to a rise in diarrhoeal diseases, sexually transmitted diseases (in the last 3 to 4 years), accident cases near the power plants. The main health problems among the local population is observed in the cases of urinary tract infections which have converted to reproductive tract infections amongst women and kidney infection amongst men.

The common ailments witnessed have been typhoid and water borne diseases wherein 10-15 cases usually are reported in a month. The other ailments relate to viral fever, complications during child birth in home deliveries and accidents in power plants where 3 to 4 cases usually are reported daily.

Views of Mr. Fazilat Khan, Local Shopkeeper and Resident of Sonarampur Village

Mr. Fazilat stated that he built his shop three years ago. The land was barren with no productivity but with the coming of the power plant in the area, he opened the general store which has benefitted him immensely. His earnings have increased 30% with an average income of 10-12 lakhs per month. He has also expanded his business to providing laundry services to people working in the power plants. In addition, he also has a small venture selling fuel woods to the local population in the area. He does not feel any negative impacts from the power plants in the area as his business has increased which in turn has increased his purchasing power. The vicinity of the power plants has also resulted in the availability of electricity in the area.

Views of Rice Mill Owners (Mr. Kamrujjaman Miah, Mr. Ataur Rahman, Md. Hasan and Md. Mozibour Rahman) of Ashuganj Bazaar

The rice mill owners collectively were of the opinion that the labourers engaged by them in rice mills receive a one-time payment of 80,000 Taka (for a man and his family) upfront for one season before engaging them. This also includes provisions of 5 kg of rice per day to the family. The women earn between 50-60 Taka per day.

The respondents were of the view that all facilities like highways, railways and boat network were already in existence prior to the coming up of the power hub. Thus, no further development is

necessary in the area. They do not perceive any impacts (negative or positive) from the Ashuganj Hub.

Photo 2: Consultation with various Stakeholders

	
Consultation with Teachers, Ashuganj East Government Primary School, Sonarampur School; Date: 21st April 2015	Consultation with Shop Owner near the Project Site in Sonarampur; Date: 21st April 2015
	
Consultation with women population in Char Sonarampur, Date: 21st April 2015	Consultation with fishermen community in Paltakanda, Date: 21st April 2015

Perception about the Project

In addition to the above consultations conducted with various stakeholders, during the socio-economic survey, a section of questions in the Interview Schedule Questionnaire for the Community regarding the perception about the project was asked to the individuals belonging to the local communities situated within 2 km radius of the project area. The respondents to these questions accounted to 41 in total. Out of these 41 respondents, 4 belonged to Ashuganj, 7 to Char Sonarampur, 7 to Char Chartola, 2 to Shohagpur, 15 to Sonarampur and 5 to Paltakanda respectively. Details of the participants are provided in Annexure XVI along with filled in response sheets. The viewpoints of the respondents have been taken cumulatively as per the area of residence to showcase the opinion of the people belonging to different areas around the project site. Details concerning the viewpoints of these respondents have been provided in (Table 5-20).

To carry out need assessment, respondents were also asked to prioritise areas of development in their village or community, providing scores on a scale of 1 to 10 ((1 being least important 10 being most).

Healthcare

Healthcare was given a high priority by respondents belonging to the villages of Sonarampur, Ashuganj Bazar, Shohagpur, Paltakanda and Char Sonarampur. All of them provided a rating of either 9 or 10. In terms of healthcare, all the respondents voiced the need for a good hospital, and not a facility that only offered OPD (Out patient) services. Respondents from Char Sonarampur added that their village did not have a resident medical doctor, and relied on diagnosis from the local ph armacist. The respondents of Char Chartola were the only ones who did not feel the need for improved health care services at all.

Infrastructure (Roads, Transportation and Electricity)

The village of Char Sonarampur is not electrified, and according to its residents, this has had subsequently contributed to their low standard of living. All commercial activities came to a halt after dusk and it was difficult for children to study after night fall. They thus rated the need for electricity as 10.

Community members from all the villages, except Sonarampur, felt that there was a need for improvement in roads and public transportation. While the rating for the same spanned between 5 and 10, the community members of Char Sonarampur reported that poor transportation facilities connecting them to the mainland was one of the main reasons for reduced business opportunities and low standard of living.

The school teachers of Sonarampur Government Primary School felt that infrastructure in their village was satisfactory and equipped to deal with the demands of both, local population and the Ashuganj Hub. They did, however express the urgent need for remediation of the school's landscape. The school had a broken building and unlevelled mud compound area which had accumulated large amounts of water leading to breeding of vectors.

Water and Sanitation

Three well educated respondents expressed the urgent need for improvement in sanitation in their communities. These were the Ashuganj Upazilla Nirbahi Officer, the Union Head of Char Sonarampur and the Senior Doctor (MBBS, MD) of Char Chartola's prominent private hospital - 'Day Night Hospital'. All three rated sanitation as 10. Both the Doctor and the Union Head emphasised on the need for education and awareness amongst the community to create an improvement in their sanitary and water handling habits. At the same time, both, the Doctor and the Upazilla Nirbahi Officer expressed concern over the pressure on the existing sanitation facilities due to the Ashuganj hub and their migrant workers.

Education

Education was given a priority by respondents by only 2 villages, namely, Char Sonarampur and Shohagpur (rating 10 and 9 respectively). While Char Sonarampur community members expressed the need for a middle and senior school, those of Shohagpur did so for a girls' college.

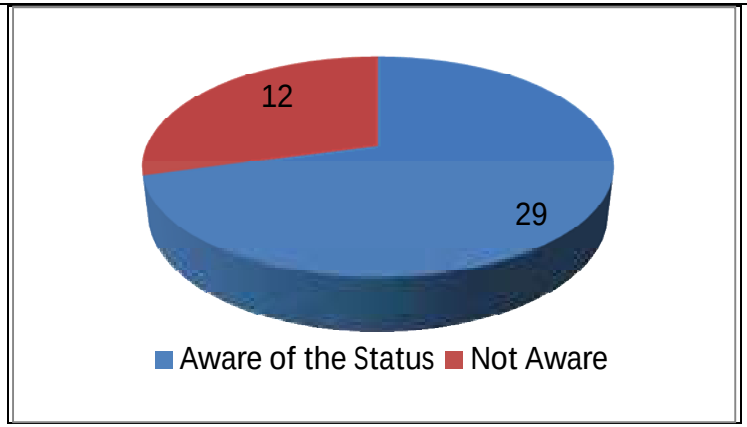
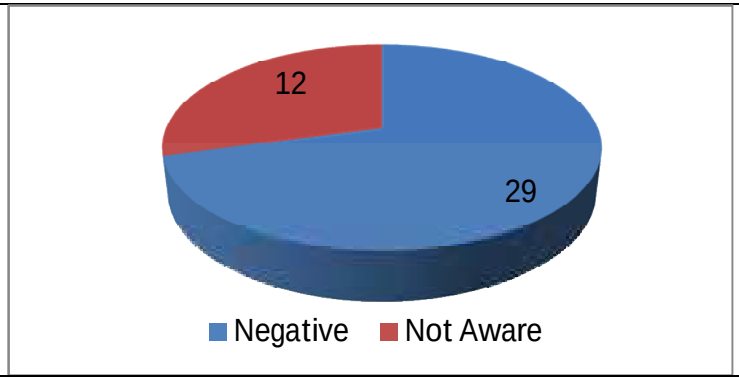
Vocational Skill Development for women

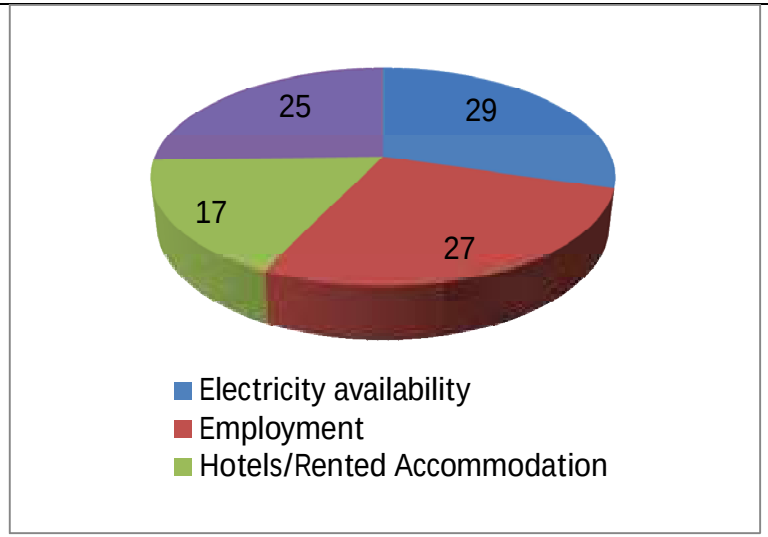
While, vocational skill development was not selected as an area requiring development, from any respondent, the same facilities for women was given a priority rating of 10, 8 and 10 by the respondents of Sonarampur, Ashuganj bazaar and Shohagpur respectively. When asked to suggest the different kinds of vocational training, the responses included 'Cloth Stitching, Teaching and Computer services'. The community members of Sonarampur expressed the specific need for adult education facilities for women, further adding that there was a definitely a demand amongst women for the same.

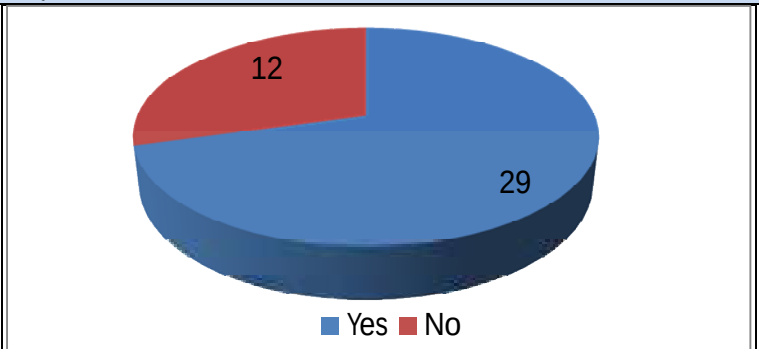
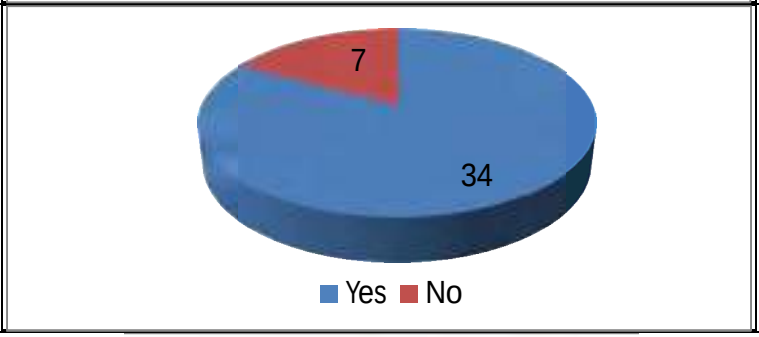
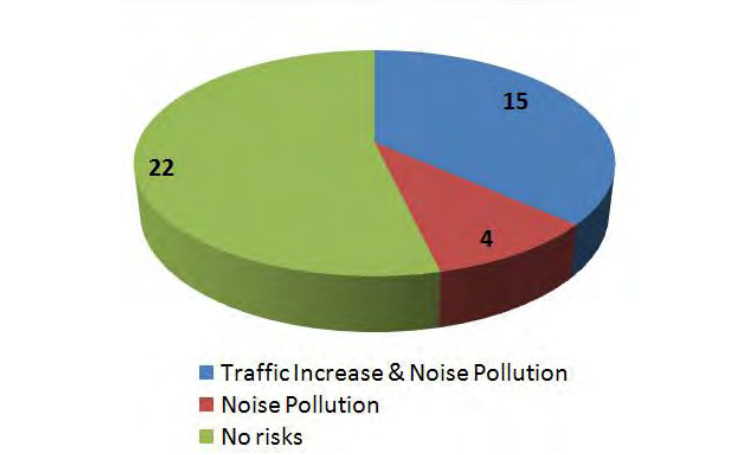
Assessment

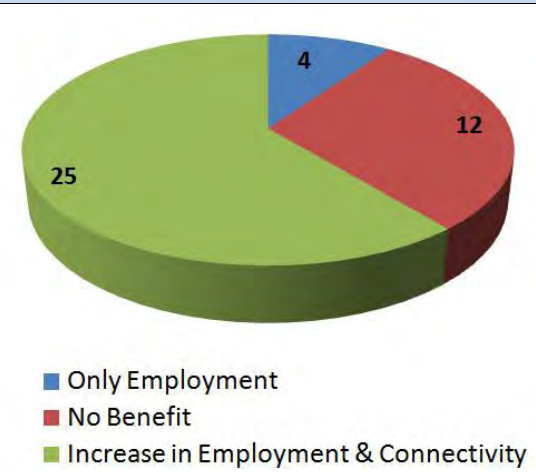
There is a clear need for improved infrastructure, especially in term of sanitation and electricity (for Char Sonarampur). At the same time, despite existing health care (private and government) facilities, there still remains the specific need for hospitals which are both reliable and affordable. Wherein education is concerned, it is evident from the Baseline section that there are several primary, middle and secondary schools in the vicinity of each Village. What appears to be the problem is the quality of the schools and education imparted by them. Lastly, there appears to be both, a need for vocational training centres for women, and a market demand for those services.

Table 5-20: Responses from Local Population on their Perception about the Project

S.No.	Questions	Response	Description
1	Awareness about the project?	All 41 respondents responded in the affirmative.	All 41 respondents were aware about the project and its location.
2	Status of land prior to the acquisition?		*Aware of the Status:* A total of 29 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur and Sonarampur responded in the affirmative about knowing the status of land prior to the coming up of the project. They stated that the area was mostly barren with a water body wherein individuals from surrounding areas used to undertake agricultural activities in patches as well as fishing activities. *Not Aware:* A total of 12 respondents from Char Sonarampur and Paltakanda responded that they were not aware of the status of land prior to the acquisition as it was at a distance from where their area of residence.
3	Was any of the project land utilized by the people for grazing/community purposes?		*Negative:* A total of 29 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur and Sonarampur responded in the negative that the project land was utilized by the people for grazing/community purposes. *Not Aware:* A total of 12 respondents from Char Sonarampur and Paltakanda responded that they were not aware of the land use pattern of the project land.
4	Any cultural heritage/ archaeological site near the project site?	All 41 respondents responded in the negative.	All 41 respondents responded in the negative about having knowledge of any cultural heritage/ archaeological site near the project site.
5	Has the land prices increased with the	All 41 respondents responded in the affirmative.	All 41 respondents responded that land prices

S.No.	Questions	Response	Description
	coming of the project in the area?		have definitely gone up in the last few years especially after coming up of the Ashuganj Power Hub to the area.
6	Has there been any change in your lives with the coming of the project? How has the change affected you?		A total of 29 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur and Sonarampur were in the affirmative that there has been considerable change in their lives with the coming of the project. While 12 respondents from Char Sonarampur and Paltakanda were in the negative and felt that no major changes have occurred with the project being in the area. *Electricity Availability:* A total of 29 respondents from Sonarampur, Shohagpur, Char Chartala and Ashuganj bazaar were of the opinion that availability of electricity had gone up with the coming of the project. *Employment:* A total of 27 respondents from Sonarampur, Ashuganj Bazaar and Char Chartala were of the view that employment opportunities have gone up in the area. *Hotels/Rented Accommodation:* A total of 17 respondents from Sonarampur and Shohagpur responded that hotels and rented accommodation in the area have increased and in turn have generated more income to the local population. *Shops:* A total of 27 respondents from Sonarampur, Ashuganj Bazaar and Char Chartala were of the opinion that shops and other business opportunities have increased in the area.

S.No.	Questions	Response	Description
7	Have employment opportunities gone up because of coming of Ashuganj Hub?		*Yes:* A total of 29 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur and Sonarampur responded in the affirmative that employment opportunities have gone up with the coming of the Ashuganj Hub in the area. *No:* A total of 12 respondents from Char Sonarampur and Paltakanda responded that there were no real changes that have emerged with the proximity of the Ashuganj Hub to their area of residence.
8	Has the traffic in the area increased?		*Yes:* A total of 34 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur, Sonarampur and Paltakanda responded in the affirmative that traffic in the area has increased considerably. *No:* A total of 7 respondents from Char Sonarampur responded that there has not been any change in traffic flow as they use their boats to reach the mainland where the Hub is situated.
9	Do you anticipate any negative risks associated with the project's operation?		*No Risks:* A total of 22 respondents from Char Sonarampur, Char Chartala, Shohagpur and Paltakanda were of the opinion that they did not perceive any negative risks associated with the project's operation. *Both Noise and Traffic Increase:* A total of 15 respondents from Sonarampur were of the opinion that major negative aspect have been the increase of vehicular movement and noise levels in the area. *Sound Pollution:* A total of 4 respondents from Sonarampur and Ashuganj Bazaar were of the view that only sound pollution in the area has increased in recent years with all the power plants that are operational in the area.

S.No.	Questions	Response	Description
10	What benefits do you see from the Project?		*No Benefit:* A total of 12 respondents from Char Sonarampur and Paltakanda responded that they do not see the local population benefitting with the Project being in the area. *Increase in Employment and Connectivity:* A total of 25 respondents from Sonarampur, Shohagpur and Char Chartala were of the view that connectivity will be strengthened due to the project in the area along with oppurtunities of employment. *Increase in Employment:* Only 4 respondents from Ashuganj Bazaar, Char Chartala, Shohagpur and Sonarampur responded that they perceive an increase in employment opportunities and purchasing power capacity amongst the local population going up with the Project in the vicinity.
11	Have you ever faced any safety, security issues or inconvenience due to outsiders working for • Ashuganj Hub • UAEL	All 41 respondents responded in the negative.	All 41 respondents responded in the negative that they have faced any safety, security issues or inconvenience due to outsiders working for Ashuganj Hub or UAEL.

5.4.4 Public Consultaions and Hearing Carried out Earlier by AECL

Public Consultations carried out while preparing EIA Report by AECL

AECL conducted stakeholder consultations around the project area on 30th October 2013. A total of 25 individuals from diverse backgrounds were consulted and their views and concerns noted. In addition, the consultants also consulted the following community members and local government and APSCL officials on 30th October 2013, details of which have been provided in (Table 5-21).

Table 5-21: List of Stakeholders Consulted on 30th October 2013 by AECL

Date	Location	Participants
30th October 2013	Ashuganj Upazila (sub district level)	Dr. Mohammad Shafiqul Islam Upazila Health & Family Planning Officer
		Mr. Md. Selim Mia Ashuganj Union Parishad Member
		Mr. Kshitish Chandra Biswas Project Director (450 MW CCPP South), APSCL
		Mr. Md. Shah Alam Manager (H&S), APSCL
		Mr. Md. Zahidul Islam Deputy Manager (HRM), APSCL
	Ashuganj Area	Mr. Mostafizur Rahman Civil Construction Sub Contractor GM Implementation
		Mr. Haji Sadequr Rahman Local Community Member
		Mr. Tofael Ali Rubel Local Community Member

Source: ESIA Report submitted by Adroit Environment Consultants Ltd (AECL)

Public Hearing carried out by UAEL

A public hearing was conducted on 22nd March 2014 at APSCL Complex, Ashuganj, Brahmanbaria District. Information relating to the public hearing was published on 13th March 2014 in The Dhaka Tribune and in The Daily Samakal, both national dailies. In addition, information was also disseminated through the focus group discussions, interviews and socio-economic survey conducted by AECL.

The public hearing was held in the premises of APSCL and was attended by a total of 27 attendees primarily from villages around the project area. A list detailing the attendees has been provided in (Table 5-22).

Table 5-22: List of attendees of the Public Hearing

S.No.	Name	Age	Profession	Contact No.
1	Md. Amanullah	38	Job	01716-475869
2	Md. Helal Uddin	21	Job	01816-400649
3	Md. Ripon Hossain	28	Job	01681-213392
4	Sachindranath Das	57	Job	01716-929635
5	Md. Sharif Khan	23	Job	01911-006210
6	Siddikur Rahman	24	Job	01839-739911
7	Julfikar Ali	24	Job	01912-631760

S.No.	Name	Age	Profession	Contact No.
8	Forhaduzzaman	30	Job	01776-477114
9	Md. Ayub Adnan	26	Job	01723-545464
10	Md. Rafiqul Islam	40	Job	01720-290364
11	Jahangir Alam	29	Job	01721-795892
12	Md. Asad	27	Job	01716-561092
13	Md. Habibur Rahman	33	Job	01790-136852
14	Md. Shahjahan	45	Job	01951-817463
15	Md. Rokan Uddin	30	Private Service	01913-401401
16	Kazi. Anwarul Kadir	25	Private Service	01727-895413
17	Shohag	35	Private Service	01916-659622
18	Md. Rejaul	25	Job	01927-560110
19	A.K.M Golam Sabbir	23	Job	01915-544629
20	Md. Ershad Hossain	45	Job	01712-764497
21	Md. Al-Amin	29	Job	-
22	Md. Fakrul Alam	30	Job	-
23	Md. Shahinur Islam	27	Job	-
24	Safiqul Islam	31	Job	-
25	Ahmed Imtiaz Raihan	30	Job	-
26	Md. Belal Hossain	42	Business	-
27	Md. Shariful Islam	45	Business	-

Source: ESIA Report submitted by Adroit Environment Consultants Ltd (AECL)

The public hearing was presided by an array of speakers. The names and designation of the speakers have been provided below:

- Md. Jamirul Karim, Project Manager, UAEL 210 MW
- Md. Kamrul Ahsan, Safety Officer, UAEL 210 MW
- Md. Dewan Alam, Electrical Engineer, UAEL 210 MW
- Md. Moniruzzaman, Plant In-Charge, UAEL 210 MW
- Md. Mobarak Hossain, UP Chairman, Ashuganj Upazilla Parishad
- Md. Masroor Abedin, Senior Environment Engineer, Adroit Environment Consultant Limited
- Mr. Ratan Kumar Biswas, Senior Environment Engineer, Adroit Environment Consultant Limited

Concerns raised by the Community

The concerns and issues raised by the community during the public hearing have been provided in (Table 5-23).

Table 5-23 : Concerns and Issues raised by the Local Communities

Issues	Concerns raised by the Communities	Suggested Recommendations by Adroit
Employment	Provision of semi skilled and unskilled jobs for locals' especially unemployed people.	Maximum unskilled jobs should be allocated to the locals
Business/ Subcontract	Opportunities should be provided to the local supplier/businessmen in getting sub contracts in terms of supplying labourers/commodities to the project.	Local businessmen and suppliers should be given preference in supplying labourers or commodities in the project.
Safer road crossing and movement of	Restriction of livestock grazing and accidents to livestock, local population especially school students	Grazing and vegetation areas should be protected and the speed of vehicles should be limited to avoid accidents in the area.

Issues	Concerns raised by the Communities	Suggested Recommendations by Adroit
people and cattle		Necessary awareness programmes on safer road crossing/movement needs to be arranged. Signage on the road intersections are required to be displayed.
Gas transmission line construction	May obstruct highway road or disturb local business during pipe layout work	UAEL provides assurance to the local community that laying of the transmission line is to be undertaken in the shortest possible time so that the work will not obstruct the road and affect local businesses in the area.
Repair of local roads	Existing roads may be damaged by construction activities	The project proponents should repair the local roads on a regular basis
Health Check up	Provision of health check-ups of school students and labourers	UAEL should arrange health check-ups for school students on a regular basis. Health check-up for the labourers of UAEL should also be done regularly so that the communicable diseases do not affect the local population.

Source: ESIA Report submitted by Adroit Environment Consultants Ltd (AECL)

Photo 3: Public Hearing held in Ashuganj Power Station Complex

Public hearing, Date: 22nd March 2014

Panel for the public hearing, Date: 22nd March 2014

Attendees participating in the Question & Answer Round, Date: 22nd March 2014

Attendees participating in the Question & Answer Round, Date: 22nd March 2014

6. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This chapter discusses potential environmental and social impacts which are likely to occur due to various project related activities. These activities include positive and negative, direct and indirect, local and regional and also reversible and irreversible impacts due to project. The impact assessment forms the basis for identification of mitigation measures and development of various management plans.

6.1 Impact Identification

The proposed UAEL power plant will comprise of 20 reciprocation engines, 20 boilers, a steam turbine and a condenser. It will employ 140 persons during operations. As already mentioned that the project is already in operation and therefore, impacts pertaining to construction phase have not been included. The impact assessment section has however, covered issues related to land.

6.1.1 Impact Appraisal Criteria

The criteria which have been employed to appraise impacts on various environmental and social components include - Spread, Duration, Intensity and Nature of impacts (Table 6-1).

Table 6-1: Impact Appraisal Criteria

Criteria	Sub-Classification	Defining Limit
Spread: refers to area of direct influence from the impact of a particular project activity.	Insignificant / Local Spread	impact is restricted within the foot prints of the project boundary or within right of way for linear projects
	Medium Spread	impact is spread from up to 2 km from the project boundary or 500 m on either side of the linear project
	High Spread	impact is spread up to 2 km to 5 km from the project boundary or beyond 500 m on either side of the linear project
Duration based on period of impact and the time taken by an environmental and social component to recover back to current state	Insignificant / Short Duration	when impact is restricted for duration less than 1 year
	Medium Duration	when impact extends up to 3 years
	Long Duration	when impact extends beyond 3 years
Intensity: defines the magnitude of Impact	Insignificant / Low Intensity	when baseline conditions are affected minimally or negligibly.
	Moderate Intensity	when baseline conditions are altered moderately
	High Intensity	when baseline conditions are significantly modified
Nature: refers to whether the effect is beneficial or adverse	Beneficial	useful to Environment and Community
	Adverse	harmful to Environment and Community

Based on the above criteria for evaluation of impacts, a matrix is developed in order to assess the significance of impacts (Table 6-2). The impacts are categorized as 'Minor', 'Moderate' and 'Major' based on the cumulative scores. Any project having beneficial impacts will have positive values while aspects having adverse effect will have negative values.

Table 6-2: Impact Significance Matrix

S. No.	Spread		Duration		Intensity		Total	
	Category	Score	Category	Score	Category	Score	Score	Category
1	Local	1	Short	1	Low	1	3	Insignificant/ Minor
2	Local	1	Short	1	Moderate	2	4	
3	Local	1	Medium	2	Low	1	4	
4	Medium	2	Short	1	Low	1	4	
5	Local	1	Short	1	High	3	5	Moderate
6	Local	1	Medium	2	Moderate	2	5	
7	Local	1	Long	3	Low	1	5	
8	Medium	2	Short	1	Moderate	2	5	
9	Medium	2	Medium	2	Low	1	5	
10	High	3	Short	1	Low	1	5	
11	Local	1	Medium	2	High	3	6	
12	Local	1	Long	3	Moderate	2	6	
13	Medium	2	Short	1	High	3	6	
14	Medium	2	Medium	2	Moderate	2	6	
15	Medium	2	Long	3	Low	1	6	
16	High	3	Short	1	Moderate	2	6	
17	High	3	Medium	2	Low	1	6	
18	Local	1	Long	3	High	3	7	Major
19	Medium	2	Medium	2	High	3	7	
20	Medium	2	Long	3	Moderate	2	7	
21	High	3	Short	1	High	3	7	
22	High	3	Medium	2	Moderate	2	7	
23	High	3	Long	3	Low	1	7	
24	Medium	2	Long	3	High	3	8	
25	High	3	Medium	2	High	3	8	
26	High	3	Long	3	Moderate	2	8	
27	High	3	Long	3	High	3	9	

6.2 Impact Evaluation

Based on the activities involved, an impact identification matrix for pre-construction, operation and decommissioning phase iss prepared for the project. The impact identification matrix is presented Table 6-3. An impact identification matrix for pre-construction and operation phase of the project has been evaluated on the following components and described further in separate sub sections:

- Land and Soil
- Water Resources and Water Quality
- Ambient Air Quality
- Ambient Noise Quality
- Ecology
- Socio-economy
- Traffic and Transport
- Occupational Health and Safety

Table 6-3: Impact Identification Matrix for Pre-Construction, Operation and decommissioning Phase of the Proposed Power Plant

Aspect/Main Activities	Sub – Activities	Impacts on									
		Air Quality	Water Quality	Surface Water Resources	Ground Water Resources	Soil and Land Quality	Noise Quality	Traffic	Ecology	Socio economic / community health & safety	Occupational Health and Safety
Land Procurement, Land use Change	▪ Livelihood loss ▪ Contamination					✓				✓	
Transportation	▪ Transportation of Gas									✓	
Plant Operations	Functioning of ▪ Boiler ▪ Turbines ▪ Generators	✓	✓	✓	✓		✓			✓	✓
Storage of Chemicals	▪ Lubricants ▪ Reagents		✓	✓		✓					✓
Water demand	▪ Water requirement for operations (steam, cooling, domestic etc.) ▪ Domestic water requirement			✓	✓					✓	
Wastewater disposal	▪ Sewage ▪ Cooling and DM rejects		✓	✓	✓					✓	
Waste Generation & Disposal	▪ Municipal Waste					✓				✓	
Employment of personnel for Plant operation	▪ Plant Operations ▪ Landscape Maintenance ▪ Security Personnel							✓	✓	✓	✓
Decommissioning	▪ Plant closure ▪ Dismantling of Equipments ▪ Transportation ▪ Site Restoration	✓	✓			✓	✓	✓		✓	✓

6.2.1 Land and Soil

The UAEL plant is located on the land parcel leased by APSCL. This land belonged to Bangladesh Railway Authority and is leased to APSCL for 99 years. The entire area leased to UAEL was mostly barren and comprised of a ditch where fishing activities were being carried out. Three fishermen with valid fishing licenses were identified and compensated as part of the agreement by APSCL with Bangladesh Railway Authority. Thereafter, the entire land parcel was filled, levelled and fenced and not used by the community for any purpose. A section of the fenced land was provided to UAEL when they were awarded the project. It is important to mention that land did not have any residential, cultural, or religious activity.

The UAEL plant is under operation and the entire area is paved with bricks (Figure 6-1). The only anticipated impact in the operation phase on the soil would be due to the seepage of Lube and other chemicals due to accidental spillage, unloading of drums and storage/ handling of empty drums.

About 341,640 litres of lube oil is required per year at the site for which 1635 drums are handled each year. At any given time, an inventory for about 15 days to 1 month of lube is maintained at site. The site also has a laboratory and small quantities of laboratory chemicals are stored there, which includes i.e., 1.5 litres of HCL and other reagents not more than 500 ml.

Another potential source of contamination to soil would be improper disposal of municipal waste if not disposed of properly

Figure 6-1: Paved View of the Plant Premises

Mitigation Measures

There are no Rehabilitation and Ressettlement issues with regard to the land parcel and same has been confirmed during the stakeholder consultations. All the licensees were given the compensations and so far no grievance has been recorded in the area.

As the site is completely paved the potential for contamination of soil from any spill or leak is comparatively low. The site has been provided with paved and covered areas for storage of hazardous waste and chemicals. All hazardous waste will be disposed of to a government authorised vendor. The engine hall has been provided with garland drains to collect any oil leak or spill during the operations. The contaminated water collected will be diverted to an oil treatment tank. This will prevent any potential for contamination to soil.

At present the municipal solid waste is stored in an open pit, which is proposed to be covered and discontinued after a tie up with Ashuganj Power Station Complex Waste Management Authority. Thereafter the waste management authority will collect municipal waste from the plant on daily basis and dispose it of to the designated location.

The above-mentioned measure will help in keeping the impact of soil to the minimum. However, the project proponent must ensure proper collection and disposal of waste as follows:

- Dustbins of good and long-lasting quality should be installed at different places to collect organic, plastic, glass and other garbage separately.
- All workers shall be instructed to put garbage in designated bins as per segregation.
- Metals, plastics, paper and glasses in the garbage shall be sold to vendors for recycling.
- No open burning of waste shall be carried out at the site.

For Hazardous material and waste the following mitigation measures should be implemented:

- All hazardous waste collected at site shall be disposed of within a defined time period.
- Segregate hazardous waste at generation point and store at a confined and designated area.
- Storage of waste lube drums shall have restricted access.
- The lube storage area needs to be provided with secondary containment and trap to control contamination of runoffs.

Significance of Impact

On the aspect of land and soil the project will have minor impact, however adequate mitigation measures shall be ensured to prevent any contamination of soil.

Table 6-4: Impact significance – Land and Soil

Aspect	Scenario	Spread	Duration	Intensity	Overall
Land and Soil	Without Mitigation	Low	Short	Moderate	Insignificant
	With Mitigation	Low	Short	Low	Insignificant

6.2.2 Water Resources and Water Quality

Rise in temperature alters the chemical and physical characteristics of water apart from having direct impacts on the aquatic life. Increase in temperature reduces solubility of dissolved oxygen in water and hence limits its availability to aquatic life. Temperature also influences the solubility of many substances (e.g. cyanide, zinc, phenol, xylene), which are toxic to aquatic life. There are many studies suggesting that higher temperatures can lead to higher respiration rates and microbial activity. As temperature rises, the zooplanktons start to grow faster than the phytoplankton, rising zooplankton population feeds on phytoplankton thereby decreasing availability of food. Higher microbial activity due to warm water in already oxygen deficient environment further compounds the problem.

Temperature rise may directly affect the metabolism, growth, behaviour, feeding habits, reproduction, geographical distribution and resistance to diseases of aquatic organisms. Influence of temperature on higher forms like fish, is also noticeable as it affects development of eggs or other propagules; larval metamorphosis, survival of juveniles and adults (heat or cold stress). Hilsa migrates upstream in the river for spawning and average temperature of 23^0C is most suitable for egg production and hatching. Other species like carps need temperature range between 24 -33^0C for spawning, fertilization and hatching (CIFRI, 1985) while Catla also shows good growth at water temperatures between 25 and 32^0C. Similarly, most of the warm water fish sustain temperature up to 38^0C.

The entire APSCL complex is dependent of the river Meghna for its cooling water demand. At present total withdrawal is about 39 m^3/s and the same quantity of water is discharged back to the river with a temperature increase of about 7 ^{0}C[17]. The UAEL plant further requires 1.67 m^3/s of river water and will discharge the same quantity of water, at a temperature 9.5^0C higher than the river water. It is important to mention that UAEL discharges the hot water to a canal through a 300 m long pipe, where the water mixes with hot water discharged from other plants, thereafter the canal caries all the hot water to the River.

To assess the impact of hot water discharge on the Meghna river, water quality software Cormix 9.0 was used. Two scenarios were considered for the modelling exercise, i.e., impact of cumulative discharge from all the operating plants without UAEL (also proposed plants of 2 x 450 MW and 225 MW) and impact of cumulative discharge from all the operating plants including UAEL.

It is important to mention that the discharge channel is fronted by an island called Char Somarampur on the Nothern side at 450 m which limits the mixing zone of the plume to the length of this island, i.e., about 1500 m downstream. Hence, for modelling a uniform channel of 450 m having a depth of 4 m has been considered. The river is extracted from the bathymetry prepared by Institute of Water

[17] *EIA, Bangladesh: Power System Efficiency Improvement Project, 2011, Prepared by the Ministry of Power, Energy and Mineral Resources for the Asian Development Bank (ADB).*

Modelling (IWM) in the year of 2012 for APSCL[18]. The input provided for modelling are presented in Table 6-5.

Table 6-5: Scenarios and inputs used for modelling

Scenario	Ambient Temperature	Hot Discharge Flow rate	Hot Discharge Temperature
Cumulative impact without UAEL	22^0C	39 m^3/s	29^0C
Cumulative impact with UAEL	22^0C	40.67 m^3/s	29.1^0C*

*Cumulative temperature of hot discharge is calculated using specific heat formulae
Heat Capacity of Water (KJ) = Specific heat of water (KJ/Kg) x Mass of Water (Kg) x Temperature (^{0}C)

The model results for scenario 1 (cumulative discharge without UAEL) are presented as Figure 6-2. The results showed that the hot water discharge remained confined with in 50 m across shore till a length of about 840 m downstream from the point of discharge. Beyond this point the hot water plume spreads and the temperature decreases sharply. The incremental temperature was observed to be less than 3 ^{0}C beyond 224 m downstream of the discharge.

The scenario 2 to assess the cumulative impact of hot water discharges from all existing and future plants along with UAEL was also executed (Figure 6-2). The plume of hot water was confined to 50 m across shore until 900 m and incremental temperature was dropped below 3 ^{0}C at a downstream distance of 235 m.

The incremental temperature with respect to the downstream distance was plotted and showed as Figure 6-4. The two scenarios do not vary much and in both the scenario incremental temperature of 3 ^{0}C is reached within a distance of 235 m. In both the scenario the plume is confined to the left bank and also achieves mixing within a short distance.

The results of the modelling study suggest that the impact due to the additional hot water discharge from UAEL is negligible as compared to the current hot water discharge. Moreover, the cumulative hot water including UAEL will also conform to the standards (40.67 m^3/s) as prescribed in the Schedule 10 of the Environmental Conservation Rules, 1997, i.e., 40 ^{0}C and 45 ^{0}C for winter and summer season respectively.

As mentioned all the water drawn from the river will be discharged back to river, thus water availability for downstream activities will not be impacted. Moreover, rise in temperature of the river is also low. The variation in temperature is expected to be within the acceptable range of tolerance of most fishes. Thus, it may be concluded that water drawl and hot water discharge will have minimal impacts on the water quality and aquatic life. Any residual impact will be restricted to the immediate vicinity of the outfall.

[18] APSCL, *Mathematical Modelling of the Meghna River in connection with the Proposed Ashuganj Power Station Master Plan and Related Services, prepared by Institute of Water Modelling, 2012.*

Figure 6-2: Hot Water Dispersion for cumulative scenario without UAEL Discharge

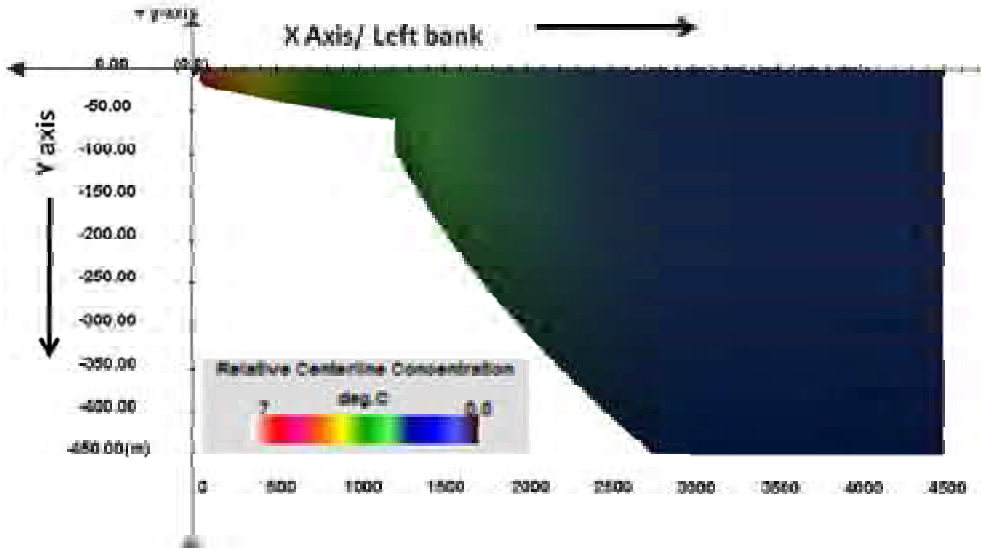


Figure 6-3: Hot Water Dispersion for cumulative scenario with UAEL Discharge

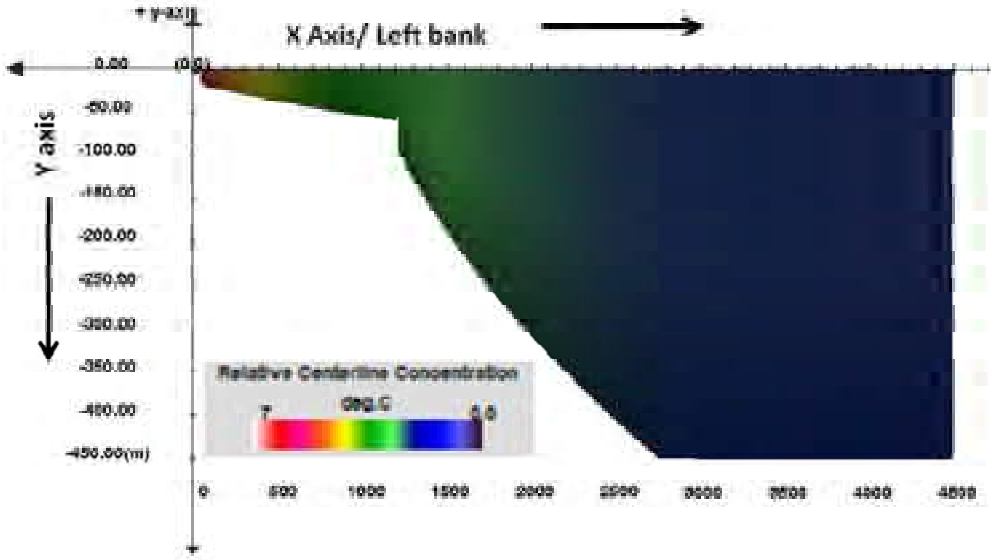
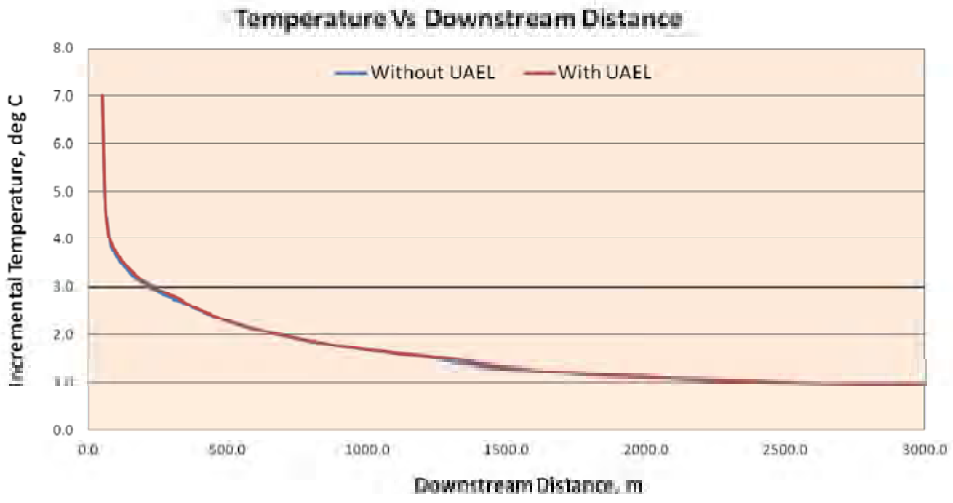


Figure 6-4: Incremental Temperature Vs Downstream Distance



Groundwater is used for drinking purposes and other industrial applications in the Ashuganj complex. The availability of ground water in Ashuganj Upazila is reported to be at about 7 metre below ground level (mbgl) and water quality is also fit for drinking. In absence of Arsenic, groundwater is used for drinking in and around the APSCL complex. River Meghna acts as a natural recharge system for ground water and moreover most of the land use is unpaved and agricultural in nature, which also allows for a good deal of water percolation and hence replenishment of groundwater.

The UAEL requires about 10.6 m^3 of groundwater per hour. Out of this about 6m^3/hr will be discharged along with cooling water as DM reject. Rest will be used for, makeup water, drinking and landscaping purposes.

The sewage generated from the plant will be disposed of using septic tank and soak pits (Refer section 3.4.5).

Mitigation Measures

As mentioned all the river water is discharged back to the river Meghna with minimal increase in water temperature. Thus, issue related to availability of water or e-flow is not foreseen in this case.

Groundwater is also available in plenty and the area has good recharge capacity thus no adverse impacts are anticipated from the marginal increase in ground water extraction for the UAEL plant.

Based on the existing activities it is observed that there will be low impacts due to water use and waste water discharge. However, the following measures should be adopted to adhere to the best practices at all times:

- There shall be one toilet each for every 15 male and also for every 10 female workers. No open defecation shall be allowed at the plant site.
- No waste water shall be disposed off outside the plant at any point of time.
- The septic tank should be cleaned regularly and sludge shall be disposed of adequately.
- Groundwater must be metered and record of extraction must be maintained at site.
- Surface runoff from oil handling areas/devices shall be treated for oil separation before being discharged.
- Strom water drains must be cleaned every year before monsoon.

Significance of Impact

As the impact on the water resources are limited and plant is also taking all necessary measures to mitigate the marginal impacts, the overall impacts assessed to be negligible.

Table 6-6: Impact Significance – Water Resources and Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resources	Without Mitigation	Low	Short	Low	Insignificant
	With Mitigation	Low	Short	Low	Insignificant

6.2.3 Ambient Air Quality

The Natural Gas available in Bangladesh is free from Sulphur content and UAEL plant is operated on Natural gas. The key pollutants due to emission of flue gases from the operation of 20 engines are the Oxides of Nitrogen (NOx). NOx are produced from the reaction of nitrogen and oxygen in the air during combustion at high temperatures.

The Ambient air quality data suggest that the area has high particulate levels which exceed the BNAAQS. The key contributors to the particulate emission are construction activity being undertaken around the site, operation of 400 – 500 rice mills and dust suspension due to vehicle movement. Although the emissions from rice mill are not significant but the cumulative impact of 400-500 rice mills operating in close proximity results in elevated level of particulates.

Earlier a study was carried out by experts of BAEC to assess the contribution of the UAEL to the total emission in the region. In this regards consultant has calculated the emission of the industries in line with the emission factor calculation and conversion by using AP42 information. The results of this analysis are provided as Table 6-7. The outcome of the study suggests that UAEL contribution in the Ashuganj Air shed is only 13.9%.

Table 6-7: List of Factories and Power Plants within 10km radius of UAEL, Ashuganj, B-Baria

S. No.	Name of Installation	Products & Services	Capacity	Emission Contribution (mg/m^3)
1	Ashugonj Fertilizer and Chemical Company Limited	Urea factory	1300 MT/day	212
2	Ashugonj Fertilizer and Chemical Company Limited	Captive Power Plant	27 MW, Steam Turbine	38.5
3	Ashugonj Power Station Company Limited	Govt. Power Plants	774 MW (Steam Turnine, Gas Turbine & Gas Engine based)	1105
4	United Ashuganj Power Ltd.	IPP Power Plant	53 MW, Gas Engine based	76
5	Agrico Power Plant	IPP Power Plant	95 MW, Gas Engine based	136
6	Precision Energy Limited	IPP Power Plant	55 MW, Gas Engine based	79
	Midland Power Co. Ltd.	IPP Power Plant	51 MW, Gas Engine based	72.8
	Emission of the Power Plants other than UAEL			1719.3
8	United Ashuganj Energy Ltd.	IPP Power Plant	195 MW, Gas Engine based	278.3

In this EIA report, cumulative assessment of air quality was undertaken for particulate matter as well as NOx using AERMOD 8.1.0. Two scenarios were simulated to assess cumulative impact of all the power plants and area sources. Scenario 1 provides cumulative concentrations without UAEL plant, while Scenario 2 considers UAEL plant along with other sources.

The inputs to Air Dispersion Modelling are summarized in Table 6-8.

Table 6-8: Inputs to Air Dispersion Modeling

S.No.	Input	Description
1	Control Pathway	
	• Dispersion Option	Non Default Option
	• Terrain	Flat
	• Dispersion Coefficient	Rural
	• Flagpole Receptors	No
2	Meteorology Input	
	• Met Input Data	Meteorological data from 1 January 2012 to 31 December 2012 (Pre-processed Meteorological Data)
	• Wind Speed Categories	A: 1.54 m/s B: 3.09 m/s C: 5.14 m/s D: 8.23 m/s E: 10.8 m/s F: No upper bound
	• Latitude	23.578239 N
	• Longitude	90.570056 E
	• Anemometer Height	14m
	• Base Elevation	3m
3	Receptor Pathway	Uniform Cartesian Grid
	• No. of X axis Receptors	71
	• No. of Y axis Receptors	71
	• Spacing for X axis	100m
	• Spacing for Y axis	100m
4	Source Pathway	Point Source
5	Output Pathway	Pollutants Ground Level Concentration
	• NOx, PM	Annual

The project has 20 stacks of 30 m height with an internal diameter of 1.2 m. The gas consumption for the plant is considered as 40 MMSCFD. The normal flue gas flow is calculated as 9.74 Nm^3/s based on unitized normal flue gas flow at 270 Nm^3/GJ (dry, 3% O_2) as per WBG guidelines (Table 6-9).

Table 6-9 : Input Values for Emission

Parameter	Value	Unit
Higher Heating Value	1045	BTU/SCF
Consumption per Engine	2359.74	m^3/hr
Stack Parameters		
Stack Height	30	m
Stack Number	20	Number
Stack diameter	9	m
Exit Temperature	443	K
Heat Input	0.027	GJ/s
Normal Flue Gas Flow	9.74	Nm^3/s (dry, 3% O_2)**
Stack Emissions		
NO_X	200*	mg/Nm^3

*As per the specifications of the manufacturer.

The Emission factor considered for the plant is 9.3 X 10^{-3} as per factors provided in AP-42 document of USEPA for Reciprocating Internal Combustion Engine.

The area has large number of gas based power projects and a fertiliser unit, it is further proposed that development of new gas based projects will also be undertaken in the area. There are a few existing power projects which will be retired as the new plants with better efficiency will start their operations. For cumulative assessment, thus a modeling exercise was undertaken in order to forecast the ambient air quality levels after implementation of new projects and retirement of the older (inefficient) ones. Emission from all the plants has been calculated based on gas consumption details collected from secondary sources and use of emission factors as per AP 42 documents of USEPA. The details of stack height and diameters used are are provided by the client and the same has been verified wherever it was possible. The list of industries considered in the model is provided in Table 6-10. The available information and reports on the new power plants suggested the use of low NOx burners and hence emission factors have also been suitably adjusted.

As per the Table below it may be noted that contribution of UAEL emission to the total emission is merely 0.8 % and 1.1 % for PM and NOx, respectively.

Table 6-10: List of Industries detailing stack heights and diameters

Stacks	ID	Height, m	Diameter, m	Exit Velocity, m/s	Emission Rate for PM, g/s	Emission Rate for NOx, g/s
20	UAEL 200 MW	30	1.2	9.74	0.11	1.45
1	Ashuganj 450 MW CCPP (North) Project	50	7.5	8.1	2.6	17.04
1	Ashuganj 450MW Combined Cycle Power Plant (South)	50	7.5	8.1	2.6	17.04
1	Ashuganj 225MW Combined Cycle Power plant	50	5	9.82	1.39	18.35
3	Ashuganj 3x150 MW Steam Turbine	50	5	9.34	1.32	18.29
1	Precision Energy Ltd (56 MW)	25	3	10.13	0.68	6.82
1	Aggreko International Ltd on the southern side of UAEL), 95 MW	5	4	9.64	1.14	11.5
1	Midland Power Company Ltd (51 MW)	20	3	9.35	0.62	6.29
1	Ashuganj Fertilizer+ Chemicals (Urea) 54.2 MT/hr	50	2	8.77	0.19	15.73
1	Ashuganj Captive power 27 MW	20	2	9.06	1.56	2.62
1	Ashuganj 50 MW Gas Engine	50	3	10.15	0.68	6.82
1	United Ashuganj Power Ltd 53MW	25	3	9.35	0.62	6.29
	Total				13.5	128.24
	Assumptions: • The following plants are not considered as they are either already retired or are proposed to be replaced o Ashuganj 2x64 MW Steam Turbine (Unit 1 & 2) o Ashuganj GT 1 35 MW (already retired) o Ashuganj ST 16 MW (already retired) o Ashuganj GT 2 40 MW • Location of stacks considered is indicative but closer to the actual plant location. • Exit temperature has been considered as 443 K for all the plants					

The fugitive emission from the nearby rice mills were estimate on the basis of 0.6Kg/T[19] and about five area sources consisting of clusters of rice mills and are considered in the PM modelling. The size of each area source and average estimated capacity of the clusters are provided in the Table 6-11.

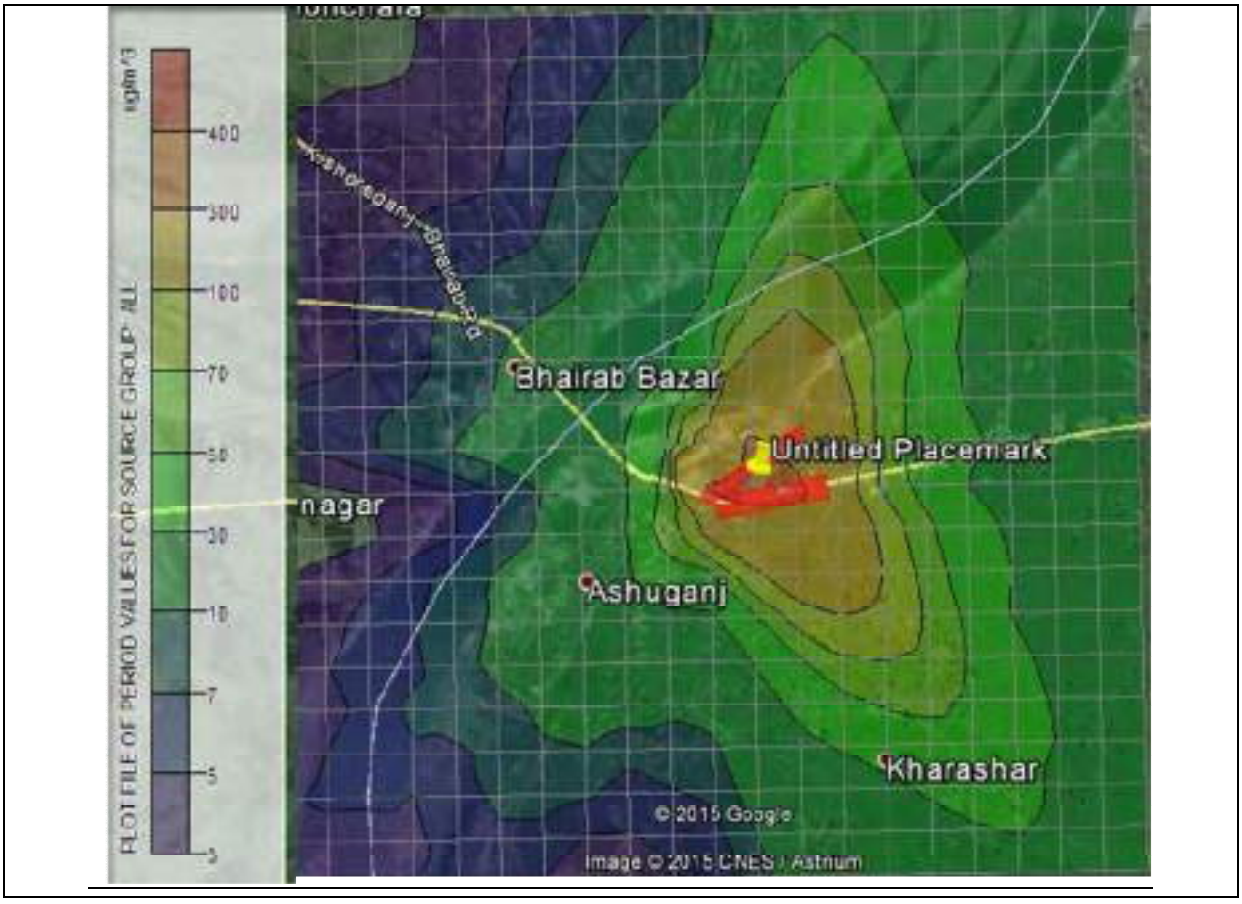
Table 6-11: Details of the Rice Mills clusters

Source Id	Area (Sqm)	Capacity (TPH)	PM10 Load (g/s-m2)
1	173,250	40	0.000038
2	44,800	5	0.000019
3	53,000	10	0.000030
4	221,000	40	0.000030
5	42,000	5	0.000020

Scenario 1 – All Sources except 200 MW UAEL Project

Based on inputs provided, predicted maximum ground level concentrations of $PM_{(10)}$ due to the emissions form all the sources except UAEL, modelled over a period one year suggest that the maximum concentration of 367 µg/m^3 is observed over the cluster of rice mills. The modelled values are in close agreement with the baseline values observed in the range of 153 - 386. The isopleth for PM_{10} modelling without UAEL plant is provides as Figure 6-5.

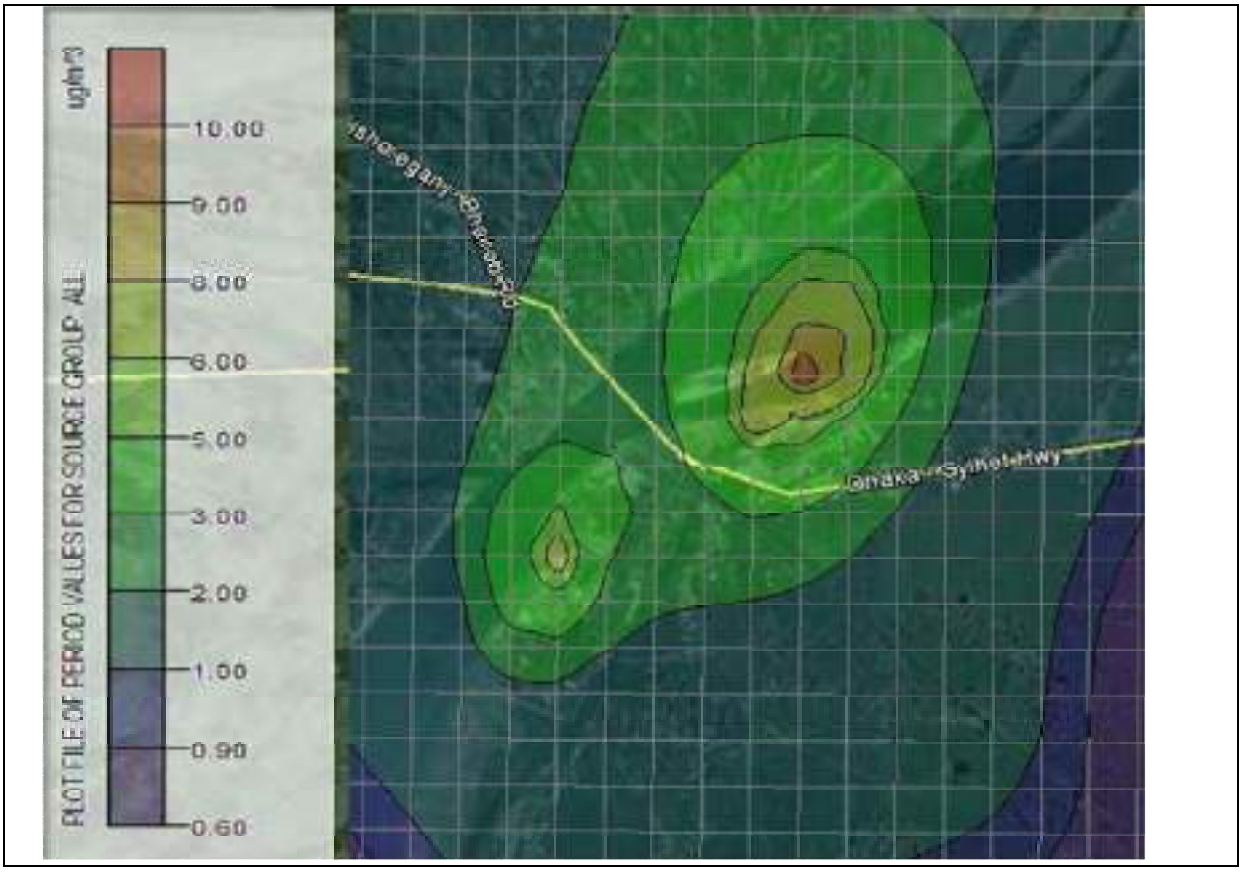
Figure 6-5: Isopleths PM for UAEL



[19] Comprehensive Industry Standard, CPCB, India, July 2008

Predicted maximum ground level concentrations of NOx due to all the sources except UAEL suggest that the maximum concentration of 9.63 µg/m^3 is observed at a distance of about 800 m North of the project boundary. The modelling exercise also shows area of about 30000 m^2 north of the plant will observe an annual average increment of between 9 and 10 µg/m^3. The isopleths for NOx modelling for UAEL plant is provided as Figure 6-6.

Figure 6-6: Isopleths NOx from Cumulative Load except UAEL



Scenarion 2 – All Sources including 200 MW UAEL Project

Based on inputs provided, predicted maximum ground level concentrations of PM_{10} due to the cumulative emissions of all sources including UAEL, modelled over a period one year suggest that the maximum incremental concentration observed is 367.6µg/m^3, which fall immediately close to the clusters of rice mills. The incremental concentration around the project site ranges between 100 and 150 µg/m^3. The isopleths for cumulative load for PM are given in Figure 6-7.

The predicted maximum ground level concentration of NOx due to the emission of all the power plants was predicted to be 26.04 µg/m^3 at a distance of about 150 m North of the project boundary. The modelling exercise also shows that an area of about 2400 m^2 on the North of the plant will observe an annual average increment between 20 and 26 µg/m^3 (Figure 6-8). The concentration due to the presence of UAEL was found to be higher due to the close proximity of all the stacks but area of high concentration is limited.

Figure 6-7: Isopleths PM from Cumulative Load including UAEL

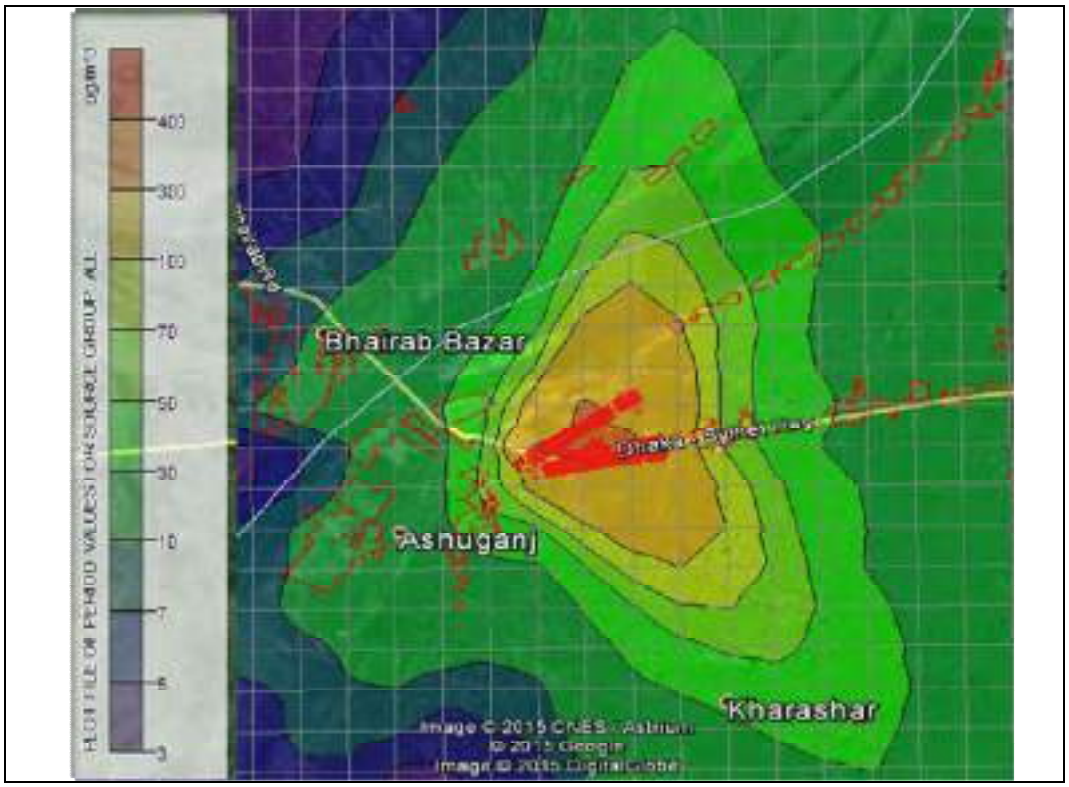
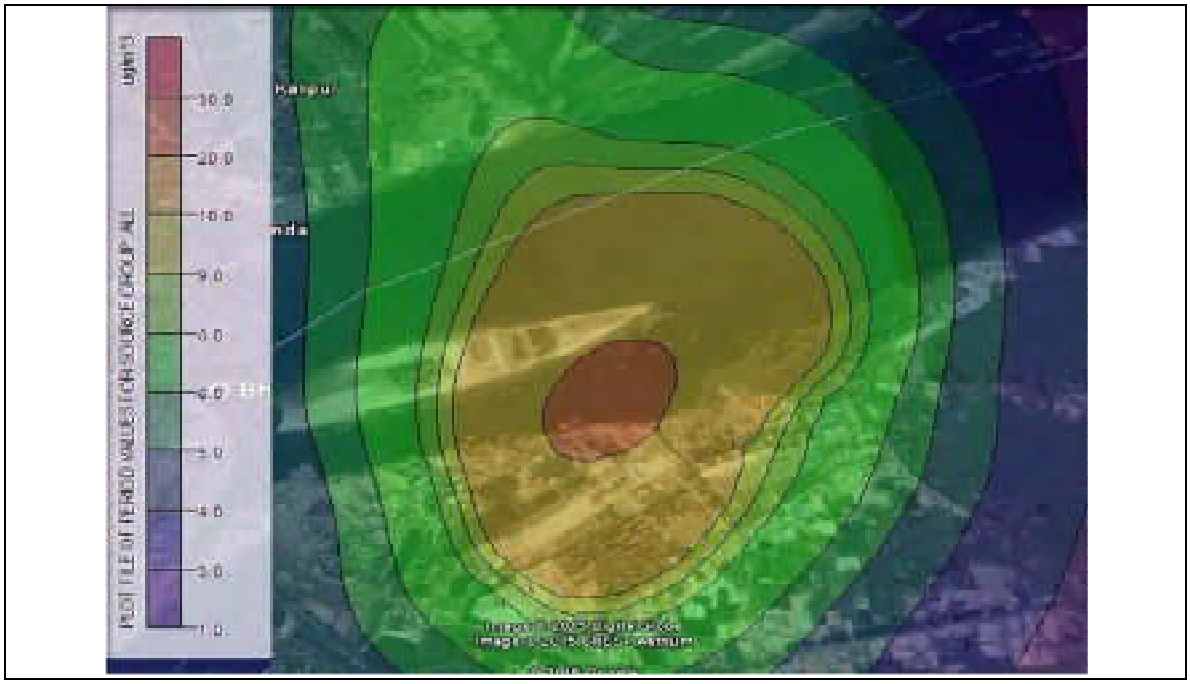


Figure 6-8: Isopleths NOx from Cumulative Load Including UAEL



The impact of PM emission from the UAEL plant is negligible as compared the contribution of other sources in particular rice mills.

The modelled maximum annual concentration of NOx is well within both WHO (40 µg/m^3) and Bangladesh (100 µg/m^3) Standards. It is therefore, concluded that the operation of the plant will not result in exceeding any of the prescribed ambient air quality standards, although there will be a small increment in concentration immediately downwind of the project.

Mitigation Measures

The impact on ambient air quality due to operation of the proposed 200 MW UAEL is limited and does not lead to significant increase in NOx levels in the area. The project proponent has already put in place stacks with 30 m height, which as per modelling results have lead to adequate dispersion of pollutants. The UAEL must undertake the following activities as mitigation measures:

- UAEL undertakes regular maintenance and upkeep of engines to ensure good thermal efficiency.
- UAEL shall also undertake bi-annual air quality monitoring to verify compliance with the National standards and commitments with the lender.
- Area which are under the control of UAEL and not yet paved shall be provided with green cover or regularly sprayed with water to avoid generation of fugitive dust, especially during summer.

Significance of Impact

The impact on ambient air quality only because of UAEL plants is limited and with mitigation measure the impact will be insignificant.

Table 6-12: Impact Significance – Air Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resources	Without Mitigation	Low	Long	Low	Insignificant
	With Mitigation	Low	Long	Low	Insignificant

6.2.4 Ambient Noise Quality

The assessment of impacts on noise of the surrounding communities depends upon:

- Characteristics of noise source (instantaneous, intermittent, or continuous in nature, with the latter contributing the least to noise pollution);
- Time of day at which noise occurs; and
- Location of noise source with respect to noise sensitive receptor.

The ambient noise levels measured within the plant, provided in Table 4-14 suggest that cumulative noise levels of the project (as the project was under trial runs when noise was measured) and other commercial and residential activities are well within the noise standards except the location on the South and South East (Section 4.11.2). The noise levels near engine hall and APSCL complex were also conforming to the standards of both day and night time.

For the purposes of predicting noise emissions impacts from the site, the noise emission sources present at the site were examined. During normal operation phase of a combined cycle Gas based power Plant, there are two types of noise generation sources:

- Stationary sources: Steam Turbine Generators, Boiler feed pumps, Generators, Cooling radiator, Exhaust Fan other rotating equipment like, major and large pumps, air compressor, ventilation fans, exhaust from steam line safety valves etc.
- Mobile sources vehicular traffic for staff mobilization, material transport etc.

In order to predict the likely impact of operations of thermal power plant on the ambient noise, it is necessary to estimate noise levels associated with equipments and components of proposed plant which will provide the basis for assessment of impact of noise generation.

A total of 42 noise major sources are identified, wherein 20 engines, equipped with cooling radiators and exhaust fan, are identified as major stationary noise generating sources for the power plant. In addition, steam turbine and A.C Generator located in the middle of engine 10 and 11 are also considered for noise assessment. Details are provided in the Table 6-13 along with the respective noise generation levels.

Table 6-13: Major Noise Generating Sources during Operation Phase

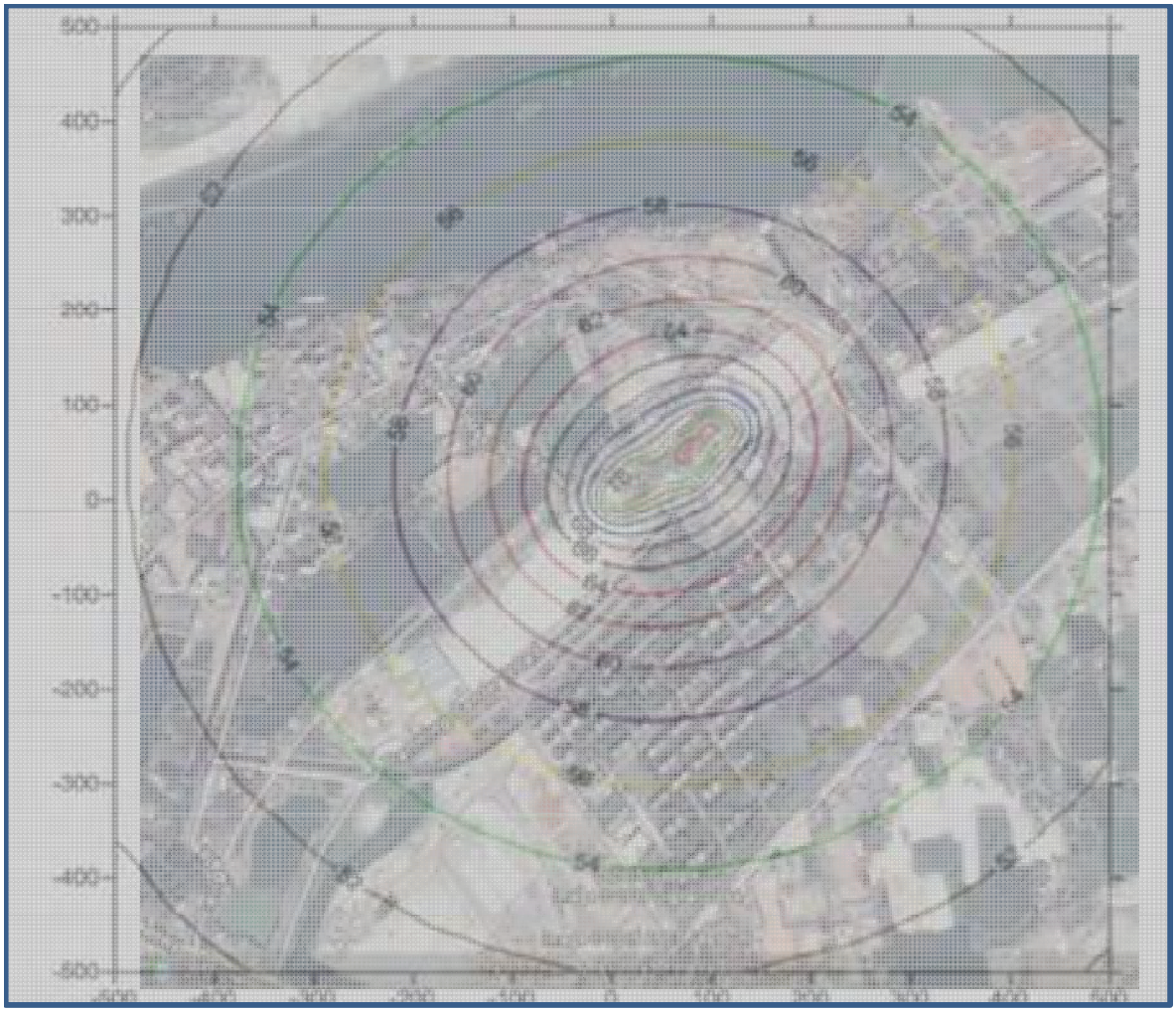
S. No.	Source	Coordinates*		Effective Noise Level in d(B)A#	Distance from the source, at which Noise levels are calculated#
		X	Y		
1	Engine 1- Cooling Radiator	0.0	0.0	61.0	40 m
2	Engine 1-Exhaust Silencer	2.0	-5.0	35.0	1 m
3	Engine 2- Cooling Radiator	4.6	3.2	61.0	40 m
4	Engine 2-Exhaust Silencer	0.0	2.0	35.0	1 m
5	Engine 3- Cooling Radiator	9.2	6.5	61.0	40 m
6	Engine 3-Exhaust Silencer	4.0	6.5	35.0	1 m
7	Engine 4- Cooling Radiator	13.2	9.3	61.0	40 m
8	Engine 4-Exhaust Silencer	10.0	5.0	35.0	1 m
9	Engine 5 Cooling Radiator	17.1	12.1	61.0	40 m
10	Engine 5-Exhaust Silencer	14.0	9.0	35.0	1 m
11	Engine 6- Cooling Radiator	26.4	18.8	61.0	40 m
12	Engine 6-Exhaust Silencer	22.0	14.0	35.0	1 m
13	Engine 7- Cooling Radiator	30.4	21.6	61.0	40 m
14	Engine 7-Exhaust Silencer	25.0	18.0	35.0	1 m
15	Engine 8- Cooling Radiator	35.1	25.0	61.0	40 m
16	Engine 8-Exhaust Silencer	31.0	22.0	35.0	1 m
17	Engine 9- Cooling Radiator	39.3	28.0	61.0	40 m
18	Engine 9-Exhaust Silencer	35.0	24.0	35.0	1 m
19	Engine 10- Cooling Radiator	43.4	31.0	61.0	40 m
20	Engine 10-Exhaust Silencer	40.0	26.0	35.0	1 m
21	Engine 11- Cooling Radiator	70.5	49.3	61.0	40 m
22	Engine 11-Exhaust Silencer	65.0	45.0	35.0	1 m
23	Engine 12- Cooling Radiator	74.6	52.4	61.0	40 m
24	Engine 12-Exhaust Silencer	70.0	48.0	35.0	1 m
25	Engine 13- Cooling Radiator	79.1	55.7	61.0	40 m
26	Engine 13-Exhaust Silencer	75.0	52.0	35.0	1 m
27	Engine 14- Cooling Radiator	83.7	58.9	61.0	40 m
28	Engine 14-Exhaust Silencer	80.0	55.0	35.0	1 m
29	Engine 15- Cooling Radiator	88.3	62.3	61.0	40 m
30	Engine 15-Exhaust Silencer	85.0	59.0	35.0	1 m
31	Engine 16- Cooling Radiator	95.9	68.0	61.0	40 m

32	Engine 16-Exhaust Silencer	92.0	65.0	35.0	1 m
33	Engine 17- Cooling Radiator	100.2	71.0	61.0	40 m
34	Engine 17-Exhaust Silencer	98.0	68.0	35.0	1 m
35	Engine 18- Cooling Radiator	104.6	74.3	61.0	40 m
36	Engine 18-Exhaust Silencer	102.0	71.0	35.0	1 m
37	Engine 19- Cooling Radiator	110.4	78.0	61.0	40 m
38	Engine 19-Exhaust Silencer	106.0	75.0	35.0	1 m
39	Engine 20- Cooling Radiator	114.6	81.6	61.0	40 m
40	Engine 20-Exhaust Silencer	110.0	78.0	35.0	1 m
41	Turbine	66.2	37.0	95.0	1 m
42	A.C. Generator	69.2	31.0	95.0	1 m

** Relative coordinates considering engine 1 as 0, 0*
 # Noise levels and distances are adopted from the specifications of Wartsila Engines (Annexure VI).

All the above mentioned noise sources identified for the proposed plant, have been considered for prediction of impact of noise levels at nearby human settlements as well as the occupational exposure to workers within the project premises. A noise modelling exercise was carried out to estimate the incremental noise levels due to operations of power plant and the spatial variations in incremental noise levels have been provided in Figure 6-9. Equivalent noise level contours have been plotted corresponding to the incremental noise levels obtained from the mathematical modelling.

Figure 6-9: Incremental Noise Levels due to Operations of Thermal Power Plant



The modelling results indicate that the maximum noise levels of 80- 87 dB (A) will only be observed with in the plant premesis. The maximum noise level of 87 dB(A) was observed to be at a distance of approximately 90 m from the Engine 1 in north-east direction (near the turbine location) while noise will reduce to about 70 dBA at the distance of 40 m from the location of the engine 1. The noise levels were observed to be less than 64 dB (A) in the APSCL complex.

The modelled noise levels were added to the baseline noise levels recoreded on 25th Feb, 2014 while plant was not operational (Refer to Table 4-15). The incremental noise values estimated from the addition of baseline noise levels and modelled noise levels due to plant operations were found to be less than 3 dB(A), which is the required standard provided in the WBG EHS Guidelines.

Table 6-14: Increment in Noise Level due to Plant Operations at the Project Office Location

	Noise level measured at the project office location		
Noise	6:00 AM	2:00 PM	10:00 PM
Noise Levels recorded, dB(A)	69.2	72.19	66.44
Noise at same location from model	66	66	66
Resulatant Noise levels, dB (A)	70.9	73.1	69.2
Increment over Baseline, dB (A)	1.7	0.9	2.8

Workers working near stacks and turbines (generator area) are more susceptible to increased noise levels due to operations of machines. The short term exposure may have impact on these workers as it may also cause loss of concentration, fatigue, a reduced capacity to work due to increased physical strain, attention deficits, and an impaired ability to communicate verbally. Table 6-15 provides the permissible noise exposures and respective limit of durations of hours a worker should be exposed. Continuous exposure to high noise levels may also result in hearing damage.

Table 6-15: Permissible Noise Exposures

S.No	Duration Per day, hours	Sound Level dB(A) slow response
1.	8	90
2.	6	92
3.	4	97
4.	3	95
5.	2	100
6.	1.5	102
7.	1	105
8.	0.5	110
9.	0.25 or less	115

Source: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735

Mitigation Measures

As mentioned engines are provided with acoustic enclosures and the doors are all sealed to avoid any noise outside. Greenbelt to be developed all around the plant will also help in noise attenuation. Additionally, the following mitigations should be adopted to deal with the impacts of noise:

- Normal working hours of the worker in the high noise area shall be restricted to 4 hours only.

- Workers working near high noise generation shall be provided with ear plugs/ ear muffs to limit exposure.
- Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components should be conducted.
- All enclosures shall be well maintained and kept closed at all times.

Significance of Impact

Impact of the UAEL plant on the ambient noise are assessed to be insignificant but existing measures and mitigation measures will help in reducing them to insignificant.

Table 6-16 Impact Significance – Noise

Aspect	Scenario	Spread	Duration	Intensity	Overall
Noise	Without Mitigation	Low	Long	Moderate	Moderate
	With Mitigation	Low	Short	Low	Insignificant

6.2.5 Ecology

It is understood that the processes involved in the installation and operation of entire Ashuganj Power plant hub and the related infrastructure-development would have caused quantitative and qualitative losses to the natural habitats therein. The development would have had direct loss of terrestrial and aquatic habitat-area, roughly equivalent to their collective foot-print occupied by them. Not only the Ashuganj development had caused disturbances to the abiotic and biotic constituents of the ecosystems of the area but it is likely to cause and may continue to cause, throughout the life, loss of life, or quality of life, for the organisms that use the area for various habitat needs such as foraging, roosting and nesting. It is quite likely that the development of the area caused fragment of the terrestrial, aquatic and aerial habitats in the past.

It would be difficult to quantify the loss at this point of time as it has been a continuous process of development. The APSCL complex was established around 1970 and thereafter it continued to expand. Though the area was reported to have many endangered species but at present it represents modified habitat with farmlands, orchards, plantations, aquaculture ponds, habitations, village ponds, embankments, roads and jetties.

The APSCL complex of 16.43 acres does not have any significant vegetation, and fauna but River Meghna provides habitat to a wide range of aquatic species. However, as discussed in section 6.2.2 the hot water discharge is not likely to have any impact on the water temperature of the river and aquatic life. There are no wildlife protection areas or ecological sensitive sites within 5 km radius of the project site. It is therefore assessed that at present, no significant impact on ecology is envisaged due to the UAEL activities.

Mitigation Measures

The following mitigation measures should be adopted to safeguard ecology:

- To compensate the loss of flora and improve environmental quality, green belt along the project site boundary shall be developed. A total of 33% will be reserved for green area.

- Native species will be selected and healthy seedlings will be planted at intervals of 4 × 4-m in 60 × 60 × 60-cm size pits filled with topsoil.
- Attempts shall be made to ensure that all open spaces, where tree plantation may not possible will be covered with shrubs and grass to prevent erosion of topsoil.
- In addition, trees/ saplings may be planted in nearby areas beyond the project site in consultation with Forest Department.

The UAEL is mandated to provide for a green zone, i.e., 33% of the plant area. The UAEL has already prepared a plantation plant (Figure 3-7). A detailed Greenbelt Development Plan is also provided as Annexure XVI.

Significance of Impact

No significant impact due to the already modified habitat of Ashuganj is anticipated due to the UAEL plant operations. Adequate green belt with local species can lead a marginal positive impact.

Table 6-17: Impact Significance – Ecology

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ecology	Without Mitigation	Low	Short	Low	Insignificant
	With Mitigation	Low	Short	Low	Insignificant

6.2.6 Social

The development of APSCL complex has also resulted in both positive and negative social impacts. The positive benefits are realised in terms of land price, business avenues, employment opportunities and Corporate Social Responsibility (CSR) initiatives undertaken by the established units. During the interactions, community and local leaders stated that there has been a rise in the prices of land in the vicinity of the entire Ashuganj hub. Simultaneously, a large number of business activities have mushroomed in the area due to the overall development and demand of additional workforce. It was reported during the consultations that small businesses such as such as tea-stalls, eating joins and restaurants, small mechanical and repair shops, hotels, pharmacies, and services such as laundry, housekeeping, and driver services have increased tremendously in the last 3 years. It was also reported, during community consultations that employment opportunities have increased in the region in the last 3 years, with many local youths providing essential services to the plants in the form of transportation, housekeeping, regular canteen and mechanical and electrical works.

Among negative impacts of the development are loss of land and livelihood, increased demand on public utilities, possibility of increase in infectious diseases, discontentment and unrest in the community due to migrant workers.

The likelihood of an increased demand on public utilities, due to the presence of migrant workforce is highest during the project's construction phase. These utilities include potable water, cooking fuel, sanitation facilities, certain foods and roads and transport facilities. However, since the Ashuganj hub has been there for much longer than UAEL's thermal power plant, any impact on the existing public utilities is likely to be cumulative. Furthermore, no related specific concerns, complaints or reports were communicated during stakeholder consultations.

Presence of the migrant population (workforce) from different regions raises a strong possibility of mild epidemics of certain infectious diseases. The most common of these are respiratory, vector borne and water borne diseases, all of which have high prevalence in the project region. The region has a high water table and the drinking water is almost entirely sourced through tube wells, thereby providing apt conditions for transmission of water borne diseases. In context to housing facilities of the migrant workforce, improper sewage system, sanitary facilities and garbage disposal mechanism, too, are likely to create ambient conditions for breeding of rodents, vectors.

Another potential impact may manifest in the form of discontentment, unrest in the community if the stakeholders are not involved in the project. Engagement includes routine and correct disclosure of related information, and effective addressing of queries, misconceptions and concerns right from the project inception phase. It also includes keeping the stakeholders involved in the planning and execution of any community development programmes/ CSR initiatives.

As reported the UAEL has procured this land on 15 years lease from APSCL, which has leased it from Bangladesh Railways Authority. Upon procurement of the land parcel, APSCL adequately compensated the fishermen having valid fishing licenses (Annexure XV). The compensation amount was estimated by Bangladesh Railways and was part one of the conditions in the lease agreement of APSCL and a total of 362967 BT were paid to these three fishermen. The land had been laying barren and unused prior to its procurement by UAEL for the project. Since it was fenced, the land was neither used for grazing of livestock by the surrounding community, nor for any commercial activity. There has been no physical or economic displacement resulting out of the land being leased to UAEL. Furthermore, the power plant falls within the compound of the APSCL and has in no way restricted the community's access to important public places such as fishing sites, schools, mosques, tube wells, sources of fodder and fuel, and local markets.

During consultations it was ascertained that locals have received benefits of the development of Ashuganj in terms of employment and business opportunities. UAEL had hired approximately 400 persons locally during its construction phase in several different capacities. Currently, during operation phase out of 140, there are 25 local persons who are permanent staff of the company. With the plant now in its operation phase, the employment opportunities for the local community are expected to emerge further, in the form for semi skilled and grey collar work.

All the staff of the UAEL, except locals, will be residing in their guest house. The UAEL will provide for all the services such as food, transport and medical aid to their staff. Hence, UAEL will not pose any competitive demand on the utilities.

Mitigation measures

- UAEL has provisions of annual medical checkups for all of its employees, to ensure good health of its migrant workforce, and minimise transmission of any infectious disease to the local community. UAEL is also advised to make provisions to include a screening for certain infectious diseases as per government or WHO protocol.
- The workforce may be provided with health promotion strategies and basic information on transmission of common infectious diseases. Where in needed, the company should collaborate

with the local health department and provide measures to prevent or contain and outbreak of diseases.

- UAEL must continue to ensure that all important routes and passages used by the community are unaffected at all times. If an when a temporary blockage is anticipated, the community must be informed prior to its blockage, signage put up and an alternate route provided. In addition, at no juncture must an important community resource such as a mosque, tube wells etc be affected without the community's prior consent.
- UAEL shall ensure adequate waste management measures to prevent any unhygienic conditions around the plant which may lead to vector borne diseases.
- The community must be informed of all major developments prior to each development in the plant, through notices and announcements, as advised in the Stakeholder Engagement Plan (Annexure XVIII).
- To avoid any communal discord, all sections of the community, except the economically weak, must be provided with equal preference where in CSR measures and employment is concerned. Economically vulnerable groups such as the Rice mill workers and fishing community may be provided a special focus in the CSR plans, to ensure contribution towards their upliftment.

CSR Initiatives

The United Group has conveyed that CSR is an integral and important part of their business process and commitment to give back to the society. With the intention of improving the lives of the socially and economically disadvantaged, the company set up the 'United Trust' in 2011 and has since then made several financial contributions towards institutional support to hospitals, schools, scholarships, Mosques and Madrassas.

In context to UAEL's 200 MW power plant at Ashuganj, the company has already provided a monetary assistance of 1,500,000 Taka to a Mosque and plans to establish a primary school and free health care facility just outside the APSCL complex.

The Following CSR recommendations have been made on the basis of Needs Assessment provided in section 5.4.2 of the report and sustainable alternatives.

Header	Observation (from ESIA Ref. 170615)	Activities	Annual Budget
Rural Education	As part of the Corporate Social Responsibility that the UAEL might take up in the future, it was suggested that a primary school, Shohagpur North Primary School is required to be developed in Shohagpur village.	1. Infrastructural development of the school Example: Repairs, Extensions	To be considered on case-to-case basis
		2. Sponsor 2 (two) Teachers	Taka 100,000
		3. Providing Furniture & Educational Equipment (Fans, Tables, Chairs, Chalk/Marker Boards, mathematical instruments, etc.)	Taka 50,000
Health & Sanitation	The village of Char Sonarampur needs health & sanitation care including outdoor medical attention	1. Installation of Tube-wells for clean drinking water (5 units annually)	Taka 75,000
		2. Installation of Toilets for sanitation (5 units annually)	Taka 75,000
		3. Weekly Clinic Services with	Taka 100,000

		sponsored doctor and medicine (1 visit per week)	
Poverty Alleviation	The company may also consider with collaborating with the Upazilla administrations or local NGOs to provide monetary assistance and training for poverty alleviation	Vocational training arrangement in collaboration with identified NGOs working in that domain, at village or Upazilla levels. The courses shall be of short durations of 2 to 4 weeks, depending upon the domain, and shall be conducted on a quarterly basis, based on the vocation's market demand.	Taka 50,000
Total			Taka 450,000

Significance of Impact

The plant will provide employment to locals and it does not have significant impact on the utilities and other services in the region. Thus, it is assessed that plant will have beneficial impacts, which will further enhance on implementation of CSR activities in the area.

Table 6-18 Impact Significance – Socio-economic

Aspect	Scenario	Spread	Duration	Intensity	Overall Significance
Socio-economic	Without mitigation	Low	Long	Moderate	Moderate (+ve)
	With mitigation	Medium	Long	Moderate	Moderate

6.2.7 Traffic and Transport

The Dhaka-Sylhet Highway is used to reach the Ashuganj from Dhaka. This is a 2 lane divided highway and the traffic count is around 1200 vehicles daily. Out of the total, 50% are commercial vehicles and about 47% are three-wheelers. During site visit no congestion was observed on the highway until the approach to Ashuganj Bazar area.

Ashuganj has a large number of non-motorised vehicles, which limits the traffic speed and causes congestions. Traffic count was also carried out at Wapda Road at the entry point of the APSCL complex. A total of 45% of vehicles were non-motorised and similar percentage of commercial vehicles ply on this road. Most of the traffic on this road is engaged to transport persons and material to APSCL plants and rice mills. No significant congestion or traffic issues were noticed on Wapda Road.

The plant personnel reported that only 2-3 trucks may be required every month to supply consumables. This is an insignificant increase in number of vehicles and will not cause any impact on the traffic in the area.

However, parking outside the facility may lead to traffic congestion near the sites and inconvenience to the local community. Unchecked speed of these vehicles may also lead to increase in accidents.

Mitigation Measures

No adverse impacts are foreseen due to the vehicles plying to serve UAEL but UAEL must undertake the following measures for proper traffic management:

- Dedicated parking area shall be provided within the project site. No trucks shall be parked outside the plant.
- The speed limit of vehicles shall be restricted to 25 km/hr on internal roads and populated areas
- In case of breakdown, provisions shall be made for quick retrieval of vehicles.
- Drivers shall be provided with training for safe driving.
- Signage to be provided in the plant and immediate access road to facilitate traffic movement and parking
- All drivers to be trained and evaluated in defensive and off-road vehicle operations.
- Inventory of the vehicles used in project along with their Pollution control documents, Driver's Licence (DL) and Registration Certificate (RC) will be maintained.

Significance of Impact

Traffic movement is assessed to be insignificant impact at site, the implementation of suggested measures will further help to keep impacts in check.

Table 6-19 Impact Significance – Traffic Movement

Aspect	Scenario	Spread	Duration	Intensity	Overall
Traffic	Without Mitigation	Short	Short	Low	Insignificant
	With Mitigation	Short	Short	Low	Insignificant

6.2.8 Occupational Health and Safety

The risk identified from transportation of gas and possible fire has been addressed as part of the Risk assessment in this report. Other occupational health and safety hazards identified for UAEL power are mainly:

- Working at Height/ Fall as maintenance activities require working at elevated areas;
- Fire and Electrical hazards, as energized equipment and power lines can pose electrical hazards for workers at power plants.

Mitigation Measures

The UAEL shall ensure that its employees follow and implement all safety measures, as provided below.

- Instructions and procedures are provided to all the workers
- Safety belt and safety nets are used while working at height;
- All works related to working at heights are undertaken during the daytime when sufficient sunlight is available;
- A work permit system for all works related to working at heights (typically when working over 2m and above) and for hot jobs are implemented;

- Prior to executing any work the integrity of the structures are inspected;
- Only trained workers in climbing techniques and the use of fall protection measures, inspection, maintenance and replacement of fall protection equipment are engaged to work at heights;
- Health and safety training is given on regular basis to all the employees;
- All safety incidents are recorded and monitored with the objective of attaining zero incidences of mishaps.
- Access to areas containing exposed electrical equipment is enclosed and posted with warning signs;
- Workers involved in electric operations are provided with Personnel Protective Equipment (PPE) such as rubber gloves etc;
- Employees involved in electrical works are trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements pertaining to their respective job assignments.
- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual fire fighting equipment that is easily accessible and simple to use
- Fire and emergency alarm systems that are both audible and visible
- Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization;
- Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components;
- Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them;
- Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tag out procedures, first aid including CPR, and proper rescue procedures.

Further detail Occupational Health and Safety Management Plan is provided as Annexure VIX.

Significance of Impact

The impact value of health and safety related aspects during plant operations are Moderate. The intensity is considered to be ‘High’ as any accident during operation may lead to fatality or disability and such loss cannot be reversed.

Table 6-20 Impact Significance – Health and Safety

Aspect	Scenario	Spread	Duration	Intensity	Overall
Health and Safety	Without Mitigation	Short	Short	High	Moderate
	With Mitigation	Short	Short	Low	Insignificant

6.3 Decommissioning Phase

Decommissioning activities depend on the proposed subsequent use of the site, but they typically consist of removal of infrastructure (e.g. turbines, substations) and reclamation of the project site and re-vegetation wherever required.

UAEL shall prepare a detailed decommissioning plan at least one year prior to the commencement of decommissioning. Removal of turbines and associated facilities shall ensure the following:

- Inform the community and relevant stakeholders about decommissioning plan and proposed subsequent actions;
- Removal of all structures including foundations to the extent possible;
- Removal of all waste collected at site, including the demolition debris;
- Noise and dust emissions to be kept low during the decommissioning;
- Roads to be retained after consultation with the community; and
- Heavy vehicle movement to be planned and informed to the community.

7. ANALYSES OF ALTERNATIVES

The World Bank's OP 4.01 necessitates examination of feasible alternatives to the proposed project site, technology, design and operation including the "without project "scenario. The subsequent section intends to assess all viable project technologies to avoid or minimize involuntary resettlement, impact on natural habitat and justification of recommended emission levels and methodologies for pollution prevention and abatement. The purpose of the alternatives analysis is to improve decisions on project technologies, construction, and operation based on feasible alternatives to the proposed project. This section compares no project scenario, alternative siting criteria and alternative technologies for the proposed project.

7.1 No Project Scenario

Bangladesh has witnessed a steep increase in demand of electricity in recent years as a result of industrial development and population growth. Anticipated peak demand in Bangladesh is 10,283 MW20 for the year 2015 as compared to 9,268 MW for the previous year. Presently, the power demand growth rate is 10%, but it has been expected to be increased at a greater rate in the upcoming years. The power sector in the country comprises of two (2) segments viz.

- Public sector – It comprises of BPDB, APSCL, EGCB, RPCL and NWPGCL
- Private sector – It is constituted by Independent Power Producers (IPP)/Supporting IPP, Rental power plants and Rural Electrification Board (REB).

The gap between installed capacity and maximum generation of electricity in Bangladesh is increasing over the years, creating pressure on supply of electricity. The peak power demand and generation figures (Refer Table 7-1) indicate an alarming increase of 31.85% in power deficit. Electricity generation is not reliable as well as the peak demands are also not met. Moreover, power price is increasing with the increments of government subsidy.

Table 7-1 : Comparison between Peak Demand and Peak Generation

Parameter	FY 2012-13	FY 2013-14	% Change in parameter
Peak Demand (MW)	7518	8349	11.05
Peak Generation (MW)	6066	6434	6.07
Deficit (MW)	1452	1915	31.85

Source: BPDB Annual Report 2013014

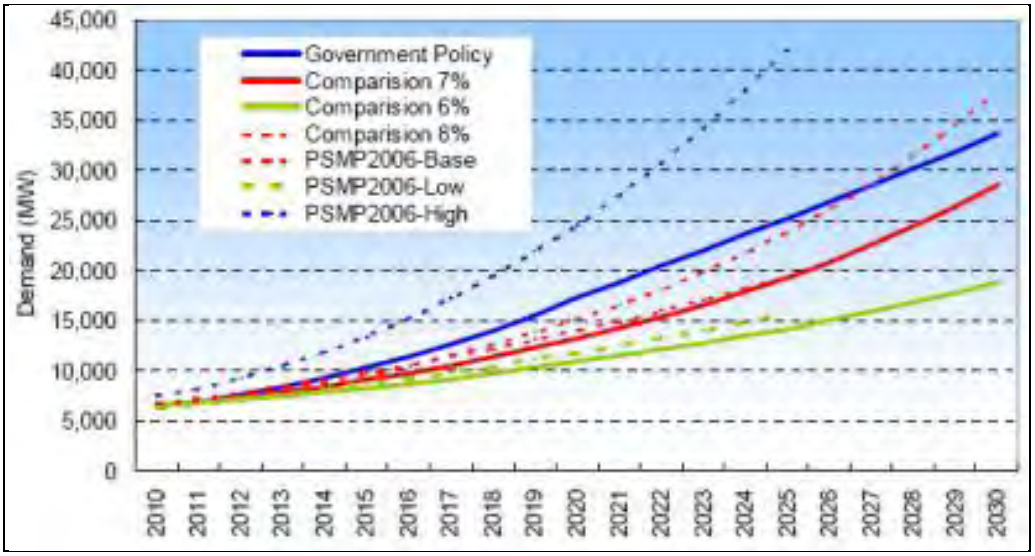
As per estimations depicted in Annual Report issued by BPDB, 68% of the country's population has access to electricity in fiscal year of 2014 while the per capita generation is only 271 kWh.21 Government of Bangladesh has assigned top priority to the development of power sector realizing its importance in economy, industrial and social development of the country. In this regard the Ministry of Power, Energy & Mineral Resources has set the vision to provide access to affordable and

[20] BPDB Power Demand Forecast : http://www.bpdb.gov.bd/bpdb/index.php?option=com_content&view=article&id=12&Itemid=126

[21] Annual Report issued by BPDB, 2013-2014

reliable electricity to all by the year 2021. The Ministry is further focusing its vision by targeting the upcoming years up to 2030 and in this regard has prepared the Power System Master Plan (PSMP) in 2010. The Plan formulated by the Ministry has anticipated a peak power demand of 24,000 MW by 2021 and 34,000 MW by 2030. Power supply targets of 24,000 MW and 39,000 MW have been envisaged under the Plan in the respective years in order to meet the rising power requirements.

Figure 7-1: Power Sector Master Plan



Source: Power Sector Master Plan, 2010 (MoPMER, Bangladesh)

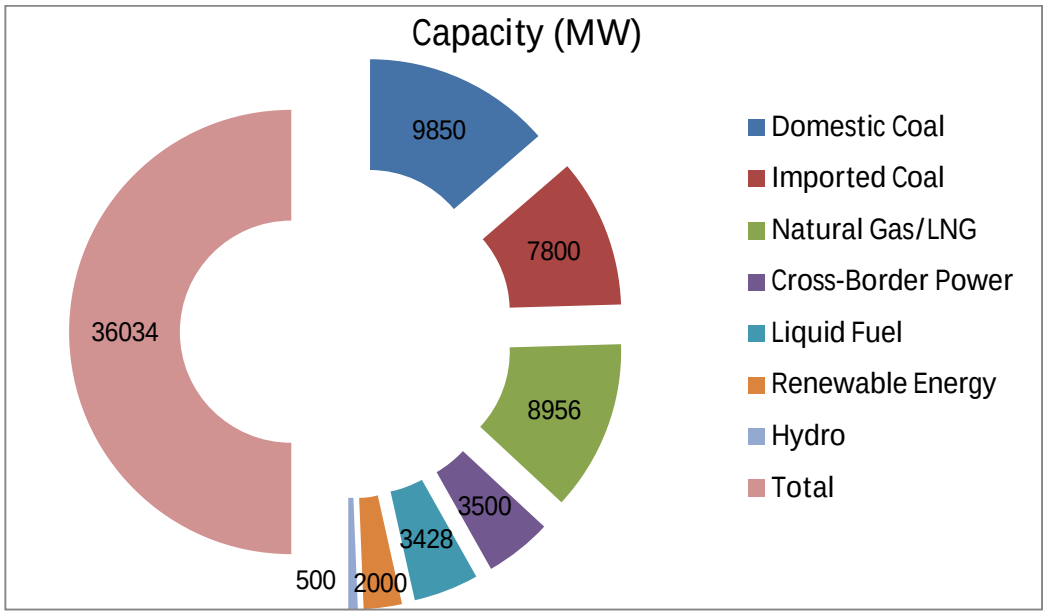
The government has designed a strategy to overcome the crisis and at the same time meet the ever increasing demands for power. It launched short, medium and long term programs to increase power supply based on introduction of fuel mix (gas, coal ,liquid fuel, nuclear energy and renewable), demand side management, energy efficiency and conservation. After assessing the latent demands, the government has revised its targets for increasing power generation. It now plans to generate 9,600 MW by 2013 and around 15,000 MW by 2016.

Between 2010 and 2016 the Government of Bangladesh has plans to generate 14,773 MW of power. Among these, 6204 MW which is 42% of the total target will be from the public sector while 8569 MW which is 58% of the total target will be from the private sector.

Further to add to the concerns, the country has five power plants aged over 40 years, 11 plants within 31 to 40 years, 23 plants within 21 to 30 years and 19 plants within 11 to 20 years. As the maximum acceptable lifetime of any power plant is 20 years, frequent tripping or technical glitches in power plants on a daily basis is hampering around 1,500 MW of electricity generation.

The government policies and plans are focussed at increasing the grid supply coverage in the country, which is currently less than 40%. The project is part of the overall effort of the government to mitigate the energy crisis. As per the Annual Report (2013-2014 issues) by BPDB, an addition of 350 MW from public sector and 791MW from private sector is envisaged. Henceforth, the project will assist in meeting the projections and vision to achieve more than 7% projected GDP growth of Bangladesh.

Figure 7-2: New Power Generation Target by 2030



Source: Power Division, Ministry of Power, Energy and Mineral Resources; (http://www.powerdivision.gov.bd/user/brec/104/110)

7.2 Siting Criteria

Siting of a Power Plant is characterized by a number of technical and economic criteria like easy availability of fuel, physical and topographical features, and increase in pollution levels and reduction in Green House Gas (GHG) emissions. The following environmental and ecological criteria have been taken into account before siting of the proposed project was undertaken.

- The location shall be away from sensitive and critical habitats on land and coastal waters (coral reefs, breeding and nesting grounds, fishing zones, migratory routes of birds and mammals);
- Baseline water quality of receiving water bodies forms an important parameter in case of hot water discharge at elevated temperatures of 7^{o}C;
- There shall be minimal to nil displacement of local population, diversion of forest and agricultural land.
- There shall be minimal to nil disturbance and losses to existing socio-economic activities and minimum depletion of available resources due to direct and induced development.

The site selection criteria employed for assessing the site has been detailed in (Table 7-2).

Table 7-2 : Justification of Criteria opted

S. No	Criteria	Justification for Site Selected
1.	Location	The proposed power plant is located inside Ashuganj Power Plant Complex, at a distance of 400m from Meghna River. Bhairab Rail Bridge is located in the south west direction of the Bhairab bridge within1.5 km distance of project site.
2.	Topography and Land Use	The topography of the area is flat and terrain is a well-developed area filled with sand.
3.	Proximity to Eco-	There is no ecological sensitive area within 5km of the study area. It is

	sensitive areas	also estimated that 1.67 m3/sec of river water would be drawn from the intake of UAEL 200 MW power project and discharged at 9.50C rise in river temperature which may not have any significant impact on river water temperature considering the volume of water available in the river.
4.	Availability of Fuel	Natural gas will be utilized as a fuel for proposed project. Bakhrabad Gas Distribution Company Ltd RMS already exists in Ashuganj Power Station Complex which will supply natural gas through pipelines to the proposed project.
5.	Involuntary Resettlement	6.48 acre of land is selected for the proposed project is vacant land and there are no houses on the site. Also, the land forms a part of Ashuganj complex and was not being used by villagers for any economic activities hence there is no loss of livelihood of the project affected villagers.
6.	Pollution Levels	A stack height of 30m has also been proposed for escape of flue gas to the atmosphere. The proposed project is a combined cycle gas engine, where Heat recovery boiler will capture heat from high temperature exhaust gases to produce steam, which is then supplied to a steam turbine to generate additional electric power. It may also be noted that the cooling water discharge shall be similar in composition to that of the water abstracted from the Meghna River expect elevated temperatures.

7.3 Alternative Technologies

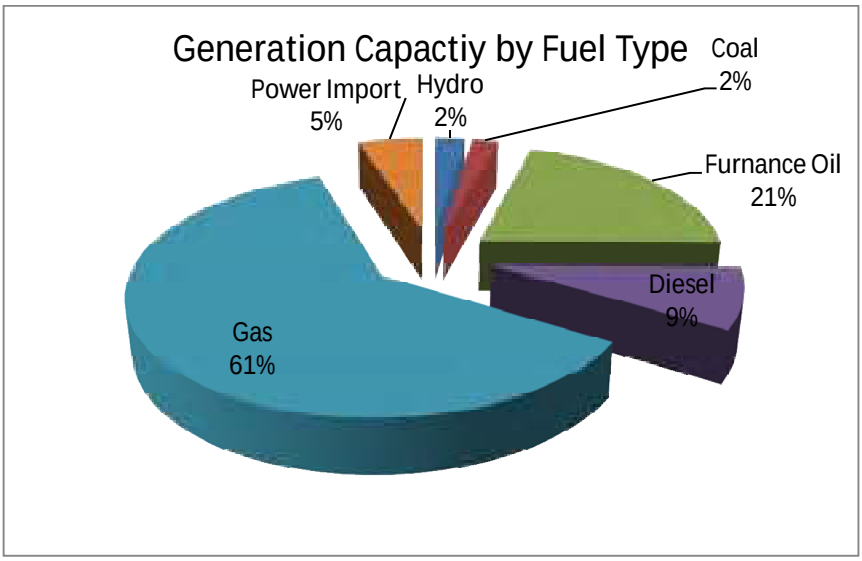
Annual Report 2013-2014 published by BPDB presents a comparison between different types of fuel utilized for power generation in fiscal year of 2014. Out of different fuels used which are Gas, furnace oil, diesel, hydro coal and import of power; Gas based power plant shares the maximum percentage of 61.26%. The share of other fuels utilized in year of 2013-2014 has been depicted in (Figure 7-3). A total of twelve (12) Gas based Power Plants are envisioned to be commissioned in the fiscal year of 2015 with total capacity of 1837 MW, wherein the proposed project will cater to 200MW of total capacity.

Current technology options for large scale generation of base load electricity in Bangladesh are limited to thermal plants utilizing fossil fuels (natural gas) and a large scale hydro-electrical scheme at Kaptai. Presently, renewable energy forms only 1.45% of total power generated in Bangladesh. Nuclear and solar options as source of electricity are being explored, however, the country does not have the expertise and infrastructure for its establishment on large scale. Renewable energy currently does not have the capacity to provide the power delivery at the scale and reliability in view of the existing power deficit scenario. Other renewable energy sources, e.g., biomass production and wind output would still be unable to produce and supply sufficient quantum of power towards meeting the existing enormous demand. As per BPDB projections, 23MW will be added through solar operated projects and 100MW will be generated through wind power projects in four years (2012-2016).

Within the scope of fossil fuelled thermal power plant technologies that are more prevalent in Bangladesh based on their feasibility, the considered options have been:

- Coal fired thermal plant;
- Oil or gas fired steam turbine;
- Oil or gas fired open cycle gas turbine;
- Combined Cycle Gas engines,

Figure 7-3: Power Generation by Fuel Type (2013-2014)



Source: BPDB Annual Report, 2013-2014

Coal fired technology has been ruled out for this project, as Ashuganj has a good supply of gas from the nearby gas fields. Moreover, it will deteriorate air quality by emission of large quantities of sulphur dioxides as well as ash disposal aspects in comparison with the power generation process involving coal fired one. Oil fired technology is less favoured than gas-fired one as the former leads to higher emissions of particulates, nitrogen oxides, sulphur dioxide and carbon dioxide. Table 7-3 presents a comparative analysis of all options considered for the project.

Table 7-3 : Comparison between Various Technology options Considered for Proposed Project

Factors	Hydro-Power	Coal	Diesel	Natural Gas
Availability	Not feasible for geographical features as there is not much difference in elevation at location near Meghna River.	Coal requirements are not economical feasible as it needs to be imported.	Diesel is also required to be imported; hence add to costs	Ashuganj Complex is located near Titas Gas Field at a distance of 1km, on left bank of Meghna River.
Feasibility	Less Feasible due to low elevation on Meghna River	Transportation of coal require strong navigation channels from Australia and Indonesia	Costs will shoot up through import of diesel from outside of Bangladesh.	Supply of natural gas will be economical through pipelines
Pollution Levels	Less pollution levels	Elevated pollution levels in terms of increased levels of SO_2, NOx, particulates and related ash disposal problems	Increased pollution levels due to addition of SO_2 levels in the atmosphere.	Relatively low air pollution concern as there will no SO_2 emissions in the air.

Source: BPDB

7.4 Alternative Design

Gas Engines are widely acceptable for meeting the peaking demand and also have the capacity to run at continuous base load.

A combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50% more electricity from the same fuel than a traditional simple-cycle plant. The waste heat from the gas engine is routed to the nearby steam turbine, which generates extra power. In comparing combined cycle with simple cycle peaking power plants it is possible to see the benefits of the combined cycle configuration by looking at performance trends like:

- Lower capital cost than other fossil fuel power alternatives;
- Short lead time for construction plus modular installation permits adapting capacity additions to fit uncertain load growth;
- Capital costs are relatively firm because of the short lead time;
- High efficiency results in lower fuel consumption with resultant minimum environmental pollution per kWh produced, and
- conservation of primary energy

8. ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

Environmental and Social Management Plan (ESMP) is a site specific plan developed to ensure that the project is implemented in a sustainable manner. The ESMP for the UAEL plant has been prepared to ensure that project implementation is carried out by taking appropriate mitigation measures to minimize impacts on the environment and social issues during its life time.

This ESMP describes the role and responsibilities of UAEL plant personnel to ensure communication and implementation of the aforesaid management plans during operation phase.

This section describes Environmental Health and Safety and Social (EHS&S) organizational structure. It describes the requirements for periodic review and updation of the ESMP to address any new impacts due to change or modification of the project and also specifies documentation and record keeping requirements for the project.

8.1 Introduction

The ESMP is specified in order to describe the mitigation measures for all the impacts associated with the project during its operation phase. Some residual impact will however persist after the all mitigation measures are employed. The ESMP intends to delineate the monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during the operational phase.

The ESMP includes the following:

- Mitigations suggested for adverse environmental and social impacts and associated risks;
- Institutional arrangement for the implementation of suggested measures;
- Monitoring arrangements for effective implementation of suggested mitigations for the project;
- Reporting requirement to the regulatory agencies and funding institutions.

As discussed in previous chapter the project has insignificant or minor impacts on account of land use, noise, water, hazardous material management etc. The moderate impacts are assessed for occupational health safety, while positive impacts were assessed for Socio-economic aspect. Mitigation measures are suggested for each one of these aspects and these are detailed in Table 8-1 along with responsibilities and time line.

An Environmental and Social Monitoring Plan is suggested to assess the compliance with respect environmental and social measures and standards in order to comply with the environmental regulation and abide to environmental standards (Table 8-2). Additionally, following detail management plans are also provided:

- Emergency Response Plan (Refer Chapter 10)
- Greenbelt Development Plan (Annexure XVII)
- Stakeholder Engagement Plan (Annexure XVIII)
- Occupational Health and Safety Plan (Annexure XIX)

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
1.	Land and Soil Environment	• Soil contamination from improper handling and spillage of hazardous waste or chemicals.	• Dustbins of good and long-lasting quality should be installed at different places to collect organic, plastic, glass and other garbage separately. • All workers shall be instructed to put garbage in designated bins as per segregation. • Metals, plastics, paper and glasses in the garbage shall be sold to vendors for recycling. • No open burning of waste shall be carried out at the site. • All hazardous waste collected at site shall be disposed off within a defined time period • Segregate hazardous waste at generation point and store at a confined and designated area • Storage of waste lube drums shall have restricted access • The lube storage area needs to be provided with secondary containment and trap to control contamination of runoffs.	To be undertaken all through the project life. Regular inspection (monthly) must be carried out to see implementation	• UAEL Environment and Social Officer
2.	Water Resource and Quality	The potential impact are: • Extraction of river water and hot water discharge;	• It is suggested that there shall be one toilet each for every 15 male and 10 female workers. • No waste water shall be disposed off outside the plant at any point of time. • The septic tank should be cleaned regularly and	To be undertaken all through the project life. Regular inspection (Monthly) must be	• UAEL Environment and Social Officer

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
		• Extraction of Groundwater • Inappropriate disposal of the municipal waste water. • Contamination of Storm water at oil handling area.	disposed off adequately. • Groundwater must be metered and record of extraction must be maintained at site. • Surface runoff from oil handling areas/devices shall be treated for oil separation before being discharged. • Strom water drains must be cleaned every year before monsoon.	carried out to see implementation	
3.	Air	• NOx Emissions from use of Natural gas	• UAEL undertakes regular maintenance and upkeep of engines to ensure good thermal efficiency • UAEL shall undertake biannual monitoring of stacks to ensure that the emissions are within the requisite limits • UAEL shall also undertake ambient air quality monitoring to verify compliance with the National standards and commitments with the lender. • Area which are under the control of UAEL and not yet paved shall be provided with green cover or regularly sprayed with water to avoid generation of fugitive dust, especially during summer.	To be undertaken all through the project life. Regular inspection (Monthly) must be carried out to see implementation Green Cover must be initiated within 1 month.	• UAEL Environment and Social Officer
4.	Ambient Noise Quality	• Noise due to operational machinery.	• Normal working hours of the worker in the high noise area shall be restricted to 4 hours only.	To be undertaken all through the project	• UAEL Environment and Social Officer

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
		• Movement of vehicles	• Workers working near high noise generation shall be provided with ear plugs/ ear muffs to limit exposure to occupational hazards. • Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components should be conducted. • All enclosures shall be well maintained and keep closed at all times	life. Regular inspection must be carried out to see implementation	
5.	Ecology	• Modification of habitat. • Development of greenbelt	• To compensate the loss of flora and improve environmental quality, green belt along the project site boundary shall be developed. A total of 33% will be reserved for green area. • Native species will be selected and healthy seedlings will be planted at intervals of 4 × 4-m in 60 × 60 × 60-cm size pits filled with topsoil. • Attempts will be made to ensure that all open spaces, where tree plantation may not possible will be covered with shrubs and grass to prevent erosion of topsoil. • In addition, trees/ saplings may be planted in nearby areas beyond the project site in consultation with Forest Department.	Green Cover must be initiated within 1 month.	• UAEL Environment and Social Officer

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
6.	Socio-economics	The project activity creates employment and business opportunity around the project area.	• UAEL has provisions of annual medical checkups for all of its employees, to ensure good health of its migrant workforce, and minimise transmission of any infectious disease to the local community, UAEL is also advised to make provisions to include a screening for certain infectious diseases as per government or WHO protocol. • The workforce may be provided with health promotion strategies and basic information on transmission of common infectious diseases. Where in needed, the company should collaborate with the local health department and provide measures to prevent or contain and outbreak of diseases. • UAEL must continue to ensure that all important routes and passages used by the community are unaffected at all times. If an when a temporary blockage is anticipated, the community must be informed prior to its blockage, signage put up and an alternate route provided. In addition, at no juncture must an important community resource such as a mosque, tube wells etc be affected without the community's prior consent. • Provision of appropriate sanitary facilities for the workforce would minimise outbreak and	To be undertaken all through the project life. Regular inspection (Bi annually) must be carried out to see implementation	UAEL Environment and Social Officer

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
			transmission of infectious diseases. • The community must be informed of all major developments prior to each development in the plant, through notices and announcements. • To avoid any communal discord, all sections of the community, except the economically weak, must be provided with equal preference where in CSR measures and employment is concerned. Economically vulnerable groups such as the Rice mill workers and fishing community may be provided a special focus in the CSR plans, to ensure contribution towards their upliftment.		
7.	Traffic Movement	• Vehicles bringing consumables will increase in traffic volume negligibly • The only impacts envisaged due to unplanned entry to the site, parking of trucks, breakdowns, etc.	• Dedicated parking area shall be provided within the project site. No trucks shall be parked outside the plant. • The speed limit of vehicles shall be restricted to 25 km/hr on internal roads and populated areas • In case of breakdown, provisions shall be made for quick retrieval of vehicles. • Drivers shall be provided with training for safe driving. • Signage to be provide in the plant and near plant to facilitate traffic movement and parking • All drivers to be trained and evaluated in defensive	To be undertaken all through the project life. Regular inspection (Monthly) must be carried out to see implementation	UAEL Safety-In-Charge

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
			and off-road vehicle operations. • Inventory of the vehicles used in project along with their Pollution control documents, Driver's Licence (DL) and Registration Certificate (RC) will be maintained.		
8.	Occupational Health and Safety	The anticipated health and safety concerns are: • Hazards like high noise, fire, electric shocks etc. • Trip and fall, inadequate fall safe arrangements.	• Instructions and procedures are provided to all the workers • Safety belt and safety nets are used while working at height; • All works related to working at heights are undertaken during the daytime when sufficient sunlight is available; • A work permit system for all works related to working at heights (typically when working over 2m and above) and for hot jobs are implemented; • Prior to executing any work the integrity of the structures are inspected; • Only trained workers in climbing techniques and the use of fall protection measures, inspection, maintenance and replacement of fall protection equipment are engaged to work at heights; • Health and safety training is given on regular basis to all the employees;	To be undertaken all through the project life. Regular inspection (Bi annually) must be carried out to see implementation	UAEL Safety-in-Charge

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
			• All safety incidents are recorded and monitored with the objective of attaining zero incidences of mishaps. • Access to areas containing exposed electrical equipment is enclosed and posted with warning signs; • Workers involved in electric operations are provided with Personnel Protective Equipment (PPE) such as rubber gloves etc; • Employees involved in electrical works are trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements pertaining to their respective job assignments. • Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. • Provision of manual fire fighting equipment that is easily accessible and simple to use • Fire and emergency alarm systems that are both		

Table 8-1: Environmental and Social Management Plan

S. No.	Component	Potential Impacts Identified	Suggested Management Plan/ Mitigation Measures	Timeline	Responsibility
			audible and visible • Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization; • Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components; • Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them; • Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tag out procedures, first aid including CPR, and proper rescue procedures.		

Table 8-2: Environmental and Social Monitoring Plan

Component	Monitoring Parameters	Frequency	Location	Reference Standards
Environment Monitoring Plan				
Ambient Air	$PM_{2.5}$ and PM_{10}, SO_2, NO_x, CO	24-hr average samples, Biannually	Project Site	National Air quality Standards of Bangladesh (2005)
Stack Emission	SO_x, NOx , CO	Bi-annually (One sample each)	All the stacks	Standards for Gaseous Emission from Industries or Projects', Schedule 11 of the ECR, 1997
Surface Water Quality - River	DO, BOD, Oil and Grease, Temperature	Bi-annually (One sample each)	• Temperature – 100 m downstream of discharge point. • Temperature 100 upstream of the discharge point • Discharge from condenser with in the plant	Schedule 12 of the ECR 1997
Ground Water Quality	Total Coliform, Faecal Coliform, pH, Colour, Turbidity, Total Dissolved Solids, Total Hardness, Total Alkalinity, Chloride, Manganese, Arsenic, Iron	Bi-annually (One sample each)	Both bore wells	Bangladesh Standards for Drinking Water (ECR'97)
Noise	Hourly Day and Night time Leq levels	Once every quarter	Ambient Noise - 4 corners of the plant and in the APSCL residential colony. Work Place Noise – 1 m from the equipments engines and turbine.	Noise Pollution (Control) Rules, 2006
Soil	Organic matter, C, H, N, Alkalinity, Acidity, heavy metals and trace metal.	1 samples; Biannually	Project Site -same as above-	-
Plantation	Monitor progress of Greenbelt	Bi-annual	_	-

	Development			
Social Monitoring Plan				
Health and Hygiene of Workers	Exposure to diseases to the Workers	Annually	-	ILO's Technical and Ethical Guidelines for Workers' Health Surveillance (OSH No.72)
Employment Opportunities	To honour the local communities demand hence giving first preference to locals	Annually		World Bank's Group Guide on Investing in People: Sustaining Communities through Improved Business Practice
Stakeholder Engagement	Build trust and amiability amongst the stakeholders involved by conducting meetings with stakeholders	Twice a Year		World Bank's Group Guide on Stakeholder Engagement for Companies doing Business in Emerging Markets
Grievance Mechanism	Grievance raised, action taken, number of grievance committee meetings	Twice a Year		Compliance Advisor Ombudsman (CAO) Guide to Designing and Implementing Grievance Mechanisms for Development Projects
Proposed CSR Activities	Implementation of Proposed CSR Activities	Twice a Year		World Bank's Group Guide on Investing in People: Sustaining Communities through Improved Business Practice
Health and Safety Monitoring Plan				
Visual inspection of use of PPE	Physical verification for integrity and safety to use In case of respirators and SCBA arrange third party fit test	Every Week Six Monthly	Within the project-site	As per the technical specifications in the user manual
Electrical Safety	- Fayed Insulation - Differently rated wires used - Industrial wiring - Industrial plug-tops - Infra-red (Heat) Surveys	Every month Annual	Within the project-site High Voltage electrical installations	None High infra-red signatures
Regular Medical Check-up of Workers	Physical Examination Audiometry Spirometry Total Lung Capacity Eye Check up Vertigo Communicable/infe	Annual For Food handlers (three monthly)	All employees including contractor workers (if exposure is high)	

	ctious Diseases			
Preventive Maintenance	Preventive maintenance of all safety equipment like emergency switches, shut-off valves, emergency response equipment, etc.	Six Monthly	All equipment	Operability based on technical specifications
Illumination	Lux Levels	Six Monthly	General work environment	Emergency light- 10 lux Work-ways – 100 Lux Maintenance works 200 lux
Work Place Noise Monitoring	Time weighted average of noise levels	Six Monthly	High and moderate Noise areas	85dbA
Pressure Vessels	Working Pressure	Six Monthly	Boilers, Compressors, Pressure Vessels and pipe lines	Safe Working pressure
Lifting Tools and Tackles	Working Load	Annual Six monthly if lifting tools/tackles are exposed to heat	All lifting tools and tackles	Safe Working load

8.1.1 Monitoring Guidelines

It is recommended that UAEL undertakes the social monitoring activities through a third party consultant/NGO. The monitoring report shall include the following:

- Date and Time of Site Visit
- Aspects Monitored
- Records of Issues
- Records of Follow Up Action undertaken by UAEL
- Records of Outcome
- Observations and analysis of the assessment.

8.2 EHS&S Management Organization Structure

For the effective and consistent functioning of the project, an Environmental and Social Management Cell (ESMC) will be established for the project. During the operation phase, this Cell will include staff from the site and corporate office of UECL.

The overall management of the project will be undertaken through coordination between UECL corporate office and project site team. The activities will be managed through Plant Manager who will be supported by the Safety in charge and Environmental and Social Officer. The Plant Manager will coordinate with Environment and Social team at corporate level.

The major duties and responsibilities of Environmental and Social Management Cell will be as follows:

- To implement the environmental and social management plan along with other associated plans.
- To assure regulatory compliance with all relevant rules and regulations.
- To ensure regular operation and maintenance of pollution control devices.
- To initiate environmental and social monitoring as per approved schedule.
- Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference.
- Maintain environmental and social consultation related records.
- Coordination with regulatory agencies such as Department of Environment, external consultants, monitoring laboratories.
- Maintain of log of public complaints and the action taken.

Figure 8-1: Proposed Environmental Management Cell

8.2.1 Site –In-Charge

Plant Manager will supervise day to day activities related to the activities at site. He will report to the corporate team on Environment. His primary duties will include:

- Act as the primary interface between the corporate staff and all the staff working at site.
- Collect, review, and disseminate information regarding all activities at site.

- Process and prepare a summary on weekly basis from feedback, complaints and comments received from team members, including safety-in-charge and Environment Officer.

8.2.2 Environment and Social Officer

The Environment and Social officer shall work in coordination with the Safety-In-Charge and report to the Plant Manager and also to Corporate Environment Manager. He shall be stationed at Ashuganj. The Environment and Social Officer will have the following responsibilities:

- Shall maintain compliance with respect to legislative and world Bank requirements;
- Carry out audits, and inspection of all the project activities;
- Shall assess the need to conduct training programs and awareness activities on environmental aspects;
- Preparation of necessary documents and record keeping system;
- Review and updating of EMP for its effective implementation;
- If case of any non-conformity, he shall escalate matter to corporate team.
- Supervise compliance monitoring and analyses.
- Undertaking community development initiatives in the project villages;
- Keep record of all the CSR activities being undertaken for the project;
- Conduct periodic meetings with local community for understanding their grievances and outcomes of the CSR activities;
- Inform the local community about the Grievance Redress Mechanism and ensure effective implementation; and
- Manage all grievances of the project and record the actions taken.

8.2.3 Safety-In-Charge

He will be responsible for all days to day activities related to health and safety at site. He shall be stationed at Site and must communicate with corporate office whenever necessary. His responsibilities must include:

- Dissemination of information about the aspects of health and safety applicable to the project to staff at site;
- Responsible for implementation of safety measures at the project site;
- Work in association with Environmental Officer for addressing issues related to working environment and safety of the workers at site.
- Periodically review the EHS performance of the project during operation phase.
- Oversee daily activities of safety executives

8.3 Awareness and Training

Trainings are necessary for effective implementation of environment management plan. The project staff must be made aware of the importance of environmental protection and safety aspects. This awareness can be provided through periodic meetings.

8.4 Record Keeping and Reporting

Records should be maintained for regulatory, monitoring and operational issues. The record keeping requirements for the proposed project is summarized in Table 8-3.

Table 8-3: Record Keeping Requirements

Parameter	Particulars
Solid Waste Handling and Disposal	• Daily quantity of waste received; • Number of trips made to the Site per truck • Daily quantity treated and recycled; and • Daily quantity sent for landfill.
Regulatory Licenses (Environmental)	• Environmental Permits / Consents from DoE; • Details of in-house monitoring capabilities and the recognized agencies proposed for conducting the monitoring. • Inventory of chemicals present at site including those in the chemical laboratory set up at site.
Monitoring and Survey	• Records of all monitoring carried out during different stages of the project
Social	• Legal Register • Training Records • Medical Check up Records • Social Monitoring Reports • Auditing Reports • CSR Activities Report • Records of Stakeholder Engagement Activities Undertaken • Complaints Register and issues attended/closed
Health and Safety	• Employee environmental, health and safety records • Equipment inspection and calibration records, where applicable • Vehicle maintenance and inspection records • Medical Report Card (for the workers on site) • Records of training and mock drills along with attendance and photographs • Accident reporting o Date and time of the accident o Incident reports o Sequence of events leading to accident o Name of hazard involved in the accident o Emergency measure taken
General	• Facility layout diagram • Process flow • Audit reports, if any

8.5 Estimated Cost of EMP Implemanttaion

Annual cost of EMP implementation is identified itemwise for this project in Table 8-4.

Table 8-4: Annual Cost for EMP Implementation

S. No.	EMP Details	Capital Cost (Takka)		Opex per annum (Takka)	
1	Provision of Dustbins and Municipal Waste Management and Disposal	Dustbin Quantity = 20 @ Taka 3,750 each	75,000	Annual Salary of 3 Cleaners @ Taka 10,000 per month	360,000
2	Provision of Drinking Water	Cost of DM Plant	10,000,000	Taka 1,800,000 as Annual O&M Expense of DM Water Plant + Take 300,000 as Annual Salary of DM Plant Operator + Taka 96,000 for additional Drinking Water	21,96,000
3	Management of Septic tank and Soak pit	Construction Cost of Septic Tank & Soak Pit	200,000	Taka 84,000 as annual salary of Septic Tank and Soak Pit cleaners + Taka 15,000 as annual Septic Tank and Soak Pit cleaning cost	99,000
4	Greenbelt development, Landscaping	Sapling Cost	500,000	Taka 96,000 as annual Salary of Gardener + Taka 200,000 as annual Watering Cost	296,000
5	Establishing Analytical laboratory	Setup Cost	1,000,000	Taka 240,000 as annual Operation Cost	240,000
6	Environment monitoring during operation	Setting up of air Monitoring Station	3,000,000	Annual Monitoring Testing Expense	12,25,000
7	EHS management team salaries	No capex	-	Annual Salary	900,000
8	Provision of PPE	First Purchase	500,000	Re-Purchase Annually	50,000
9	Medical Check ups	First Aid Kit at plant	-	Annual Maintenance	350,000
10	Training and awareness	No capex	-	Annual Budget	200,000
	TOTAL		1,52,75,000		59,16,000

9. HAZARDS IDENTIFICATION AND RISK ASSESSMENT

Hazards Identification is the primary task for planning for risk assessment. Hazards are caused due to the nature of chemicals handled and process involved. Hence for risk assessment the first step is to identify the hazardous chemicals, which poses the risk of Fire, toxic releases resulting in the fatality or property damage of proposed unit. Risk analysis deals with the identification and quantification of risks, associated with the hazard, which has potential to cause accidents at work place.

9.1 Anticipated Risk and Hazard during Operation Phase

The Power generation Units at Ashuganj (Bangladesh) will receive Natural Gas through a 10" pipeline from the gas Grid, which is about 900 meters away. Hence the main hazard is the rupture of Gas pipeline which is coming at a pressure of 70 psi, 37 ^{0}C (approx.) resulting in fire or explosion. The explosion may be caused due to release of Natural Gas and formation of Gas cloud, which may ignite resulting in overpressure or blast waves.

Considering the operational details the anticipated hazards are defined in Table 9-1.

Table 9-1: Identified Hazards at UAEL Plant

S. No.	Hazardous Area	Fire, Spontaneous combustion/Explosion
1.	Natural Gas Carrying pipeline	Fire, Explosion, Formation of Gas cloud* *Quantitative Risk Assessment using ALOHA Model is described below)
2.	Boilers	Fire (Mainly near burners), Steam explosion, Gas /Fuel Explosion
3	Gas Turbine Generator Building	Fire in :- a) Lube oil System b) Cable Galleries c) Short circuit in : i)Control Room, ii)Switch Gears d) Explosion due to gas or Vapour formation followed by Fire.
4	Acid & Alkali/Caustic handling	Acid & Alkali leak/spillage during its handling.

9.2 Quantitative Risk Analysis using ALOHA

<u>Calculation of damage distances due gas pipe line rupture resulting in Fire, Explosion and Formation of Gas cloud</u>

ALOHA Model is used for the analysis of the fuel gas, i.e., natural gas (Methane mainly) fed to the gas engine for power generation to quantify the damage distances for the power project of UAEL. The Fire and Explosion Analysis (FEA) is carried out with a view to:

- Identify the areas that could be affected.
- Quantify the expected damage due to potential fire and explosion.
- Prepare guidelines for mitigating fire and explosion hazards.

The loss scenario which could actually be experienced under the most adverse operating conditions is quantitatively evaluated.

The aim is to assess the threat zone due to Natural gas leak, a potential hazard, related to feed gas flow (natural gas a Flammable material) considering various scenarios to prepare a database to assess threat zone ie affected area in an emergency situation.

There are two scenarios which have been modelled considering average weather conditions prevailing at any given point and time. Details of modelling inputs have been presented in the Annexure XX along with relevant graphs.

- Scenario 1 – Calculation of gas cloud spread zone in case of leaked natural gas from rupture of pipeline (full bore failure) spreading without getting an ignition source ie not burning whilst the gas is being dispersed in atmosphere and secondly the blast area due to flash fire (In case, the gas cloud gets an ignition source) are modelled, which is presented below.
- Scenario 2 – The leaked natural gas from Natural Gas pipeline (Full bore failure) and spreading and getting an ignition source, whilst the gas is being dispersed resulting in fire.

The Thermal Radiation Threat zone and its radiation Intensity, lethal nature casing different degree of burn and fatality as well as the explosion zone has also been modelled.

Table 9-2: Analysis of Flammable area vapor cloud

Threat Zone	Affected Distance from the source (m)	Flammable area vapour cloud (ppm)	Remarks
Red	68	50000	Highly Flammable zone
Orange	88	30000	Flame Pockets
Yellow	217	5000	Low Flammable Zone

Figure 9-1: Fuel not burning whilst the gas is being dispersed through the pipeline - Flammable area vapor cloud

Table 9-3: Analysis of Blast Area Threat Zone

Threat Zone	Overpressure (blast force) (psi)	Likely Affects	Remarks
Red	8	Destruction of buildings	High Impact Zone
Orange	3.5	Serious injury likely	Medium Impact Zone
Yellow	1	shatters glass	Less Impact Zone

Figure 9-2: Fuel is not burning whilst the gas is being dispersed through the pipeline – Blast area threat zone

The modelling predicts that in Scenario-1, the flammable area vapour cloud is expected to stretch until 217m at a concentration of 5000ppm at the least and at a distance of 68m or less the concentration is expected to be the highest at 50000 ppm. The affects of blast area threat is predicted to be shattering of glass in the 76 metre zone.

9.2.1 Thermal Radiation

Thermal radiation effects on inanimate objects like piping, equipment or vegetation also need to be evaluated to assess their impact. Figure 9-3 presents the affected distances due to thermal radiation intensities.

Table 9-4: Analysis of Thermal Radiation Threat

Threat Zone	Affected Distance (m)	Lethal nature of thermal radiation (kW/ m2)	Affects to Personnel
Red	20	10	potentially lethal within 60 sec
Orange	33	5	2nd degree burns within 60 sec
Yellow	53	2	pain within 60 sec

Figure 9-3: Burning whilst the gas is being dispersed through the pipeline – Thermal radiation threat zone.

From the Table 9-4 it can be inferred that the thermal radiation is predicted to extend till 53 meters. In the red zone at 20 m or below the thermal radiation is expected to be 10kW/sq m and is potentially lethal. Similarly, in orange zone 2nd degree burns can be expected within an exposure of 60 seconds and pain at distance between 33 and 53 meters.

9.3 Effective Controls

Generally, the gas turbine and generator are put together in an enclosure with fire and gas detection, alarm, and suppression systems. The enclosure is protected by with carbon dioxide suppression system and the fire alarm system is set on “auto”, so the detection and alarm system is ready to activate at any sign of danger. The enclosure of the gas turbine-generator may be opened only to check the inside of the unit when the fire detection panel is on “inhibit” to prevent discharge of CO2 into the enclosure. The operator should be aware of asphyxiation if CO2 is discharged. Asphyxiation is when someone suffocates and is unable to breathe normally because of a depletion of oxygen.

9.3.1 Gas Detection System

The gas detection system is to remain active and powered, and support the entire plant, at all times. The system must be checked and the detectors calibrated per manufacturer’s recommendations. It is connected to the fire alarm panel, emergency power, and battery backup system. The fire alarm panel may connect to output devices such as gasvalves, fan, dampers, and inlet air and shut them down in case of a serious alarm. Visual inspections must be conducted at least once per shift. If there are supervisory or trouble signals, observe the gas detection panel and find out which detectors are in alarm. Acknowledge the alarm and investigate the cause of the alarm and try to clear it. If an irregular condition persists, log it in the log book and bring it to the plant manager’s

attention. Confirm appropriate fans are running, take remedial action, and evacuate area if levels of natural gas or CO continue to rise. Once levels of gas have returned to normal, observe the detectors are working, and reset the gas detection panel, fire alarm system, and gas valve (if gas valve shutdown has occurred).

If there are supervisory or trouble signals, observe the gas detection panel and find out which detectors are in alarm. Acknowledge the alarm and investigate the cause of the alarm and try to clear it. If an irregular condition persists, log it in the log book and bring it to the plant manager's attention. Confirm appropriate fans are running, take remedial action, and evacuate area if levels of natural gas or CO continue to rise. Once levels of gas have returned to normal, observe the detectors are working, and reset the gas detection panel, fire alarm system, and gas valve (if gas valve shutdown has occurred).

9.3.2 INERT PURGING

It is dangerous to introduce natural gas into the piping systems and components when the system is filled with oxygen from the air. An explosion may result when a certain concentration of natural gas and oxygen mixes. During initial start up and taking the system out of service, natural gas piping is purged with inert gas or nitrogen throughout the system to displace all the oxygen in the pipes. During startup, nitrogen is fed into one end of the system and the concentration coming out of the other end must be tested to ensure that little or no oxygen remains in the system (less than about 8% oxygen).Then, the gas valves may be opened to introduce natural gas into the system, and the concentration of methane is tested, for about a concentration of 98%, and allow normal operation of the Co-Gen. When taking the system out of service, the opposite procedure occurs and nitrogen is introduced into the pipes to remove natural gas. Whenever there is a filter, a purge may be performed prior to removing the filter to remove natural gas odor. For example, filters in the gas compressors may be purged before the filters are changed to prevent strong natural gas odor from being released to the atmosphere or affecting people in surrounding area.

9.3.3 Combustible Flue Gas Operations and Purging

The vent valves, bypass, and stacks are open during startup and closed before normal operation. During shutdown, natural gas and unburned fuel in the system are safely purged and vented out before the system completely shuts down and is exposed to oxygen in the air again. This purge of components for the boiler or the HRSG, may be performed during operation or after shutdown to purge out flue gas or remove unburned fuel from gas piping. After the fuel gas valve shuts, theventilation fans are run, the flue gas is purged into a furnace or runs through a stack. Usually, the purge of combustible flue gas is for duration of 6 times, or at least 5 minutes. The combustible and boiler system hazard codes are outlined in NFPA 85, and each Co-Gen plant has a NFPA 85 required combustible flue gas operation and purging procedure specific to each site

9.3.4 Miscellaneous

The Pipeline Design shall consider adequate sizing, thickness and pressure to ensure safety during transportation of gas. The route of gas transport shall be adequately marked and no digging, drilling or construction activity shall be allowed without prior information to relevant authorities. Adequate sign boards shall be put in place to enhance awareness of public and workers.

In case leak is detected or suspected, all ignition sources in the vicinity shall be turned off, the authorities shall be immediately informed and measures shall be taken to shut down the supply from RMS.

UAEL shall put in place a blanket ban on smoking and ensure adequate monitoring of pipeline from time to time for corrosion or damage. The thick green belt proposed will help to mitigate the radiation intensity level outside plant boundary. The team shall respond to emergency situation as per the Emergency Response Plan provided.

9.3.5 Fire Fighting Arrangements

- First Aid Fire fighting equipment suitable for the type of fire should be maintained as per statutory requirements of Bangladesh. Fire hydrant line converting major areas shall be laid. It would be maintained as 6 kg / cm2 pressure.
- The fire fighting water shall be supplied from raw water reservoirs. Fire water pumps will be located in the raw water pump house adjacent to raw water reservoir. There shall be two (1) nos.100% capacity electric motor driven hydrant cum spray pumps and one (1) no.100% diesel engine driven hydrant cum spray pump.
- Two electric motor driven jockey pumps & two air compressors along with a hydro pneumatic tank shall be provided to maintain required pressure in the fire water header mains off-setting the minor leaks in the system.
- A comprehensive fire detection and protection system is envisaged for the complete power Plant. The fire detection and protection shall comprise of Hydrant system for complete power plant covering the entire power station including all the auxiliaries and buildings in the plant area. The system will be complete with piping, hydrants, valves, instrumentation, hoses, nozzles, hose boxes/stations etc.
- Portable and mobile extinguishers, such as pressurized water type, carbon-dioxide type, foam type, dry chemical powder type, will be located at strategic locations throughout the plant.
- Gas masks and general first aid materials for dealing with fire burns would be maintained in the medical centre as well as in the emergency control room.
- Necessary medicines for emergency treatment of Burns patients and for those affected by toxicity would be maintained. Breathing apparatus and other emergency medical equipment would be provided and maintained. The help of nearby industrial managements in this regard would be taken on mutual support basis.

10. EMERGENCY RESPONSE PLAN

The purpose of the Emergency Response Plan (ERP) is to identify potential foreseeable accidents/emergency situations and establish and maintain procedures to address or prevent such situations, as well as to test the effectiveness/review/revise such procedures periodically.

The scope of the ERP will be applicable to all project activities associated with the construction and operation phases of the Project. The elements of the DMP will be directly implemented by the contractors and their sub-contractors, with UAEL having overall management and responsibility.

UAEL needs to monitor and review the implementation process of DMP on regular basis.

10.1 Approach & Objectives

The basic approach towards preparedness for any major disaster or emergency situation will comprise of the following activities:

- Identify the potential disasters likely to occur;
- Establish an Disaster/Emergency Response Team (ERT) to implement emergency procedures;
- Develop a detailed Emergency/ Disaster Response Plan with details regarding the course of action to be followed in order to minimize personal injury and property damage in the event of fire, flood, loss of ground, or natural disaster;
- Train the personnel in planning and responding to an emergency/ disaster.

The plan is developed to make best possible use of resources at its command and /or outside agencies for the following purposes:

- Prevention, Mitigation & Preparedness (Pre phase)
- Response, Rehabilitation & Recovery (Post phase)
- Safe guard others by evacuating them to safer places;
- Rescue of victims and treating them suitably to effect speedy recovery at hospital;
- Identify the personnel affected / dead;
- Inform relatives of those deceased / affected;
- Providing relevant records / data needed as evidence for subsequent enquiry;
- Rehabilitation of the affected persons.

10.2 Possible Emergency Situations

Hazards can be categorized as

- Natural hazards
    - Earthquake;
    - Flood; and
    - Fire hazards;

- Technological hazards
    - Fire & Explosion;
    - Electrical shock;
    - Hazardous material release;
    - Transportation accident.

10.3 Emergency Preparedness

Emergency preparedness is important to ensure appropriate response to unexpected or accidental incidents. It involves:

- Inventorisation of hazardous material/ aspects leading to emergency situations;
- Establishing emergency organization and responsibilities;
- Developing emergency response plan;
- Evaluating medical fitness of designated responders;
- Establishing needed agreement with the following:
    - Fire
    - Police
    - Hospitals
- Ambulance services;
- Establishing internal and external communication;
- Preparing evacuation route and procedures;
- Adequate arrangement of medical facilities and first aid treatment at site;
- Conducting safety training and mock drills as required;
- Conducting evacuation drill for employees.

10.4 Emergency Identification

Identification of causes and types of emergencies is the primary task for planning of risk assessment. Emergencies can happen because of the nature of chemicals handled and also the nature of process involved during operation phase of the project.

10.5 Operational Activities

Following potentially hazardous areas and activities have been identified during operation phase of the project, which are likely to lead to emergency situations such as fire, explosion, electric shocks etc.:

- Leakage of gas may result in fire and explosion;
- Blast of pipeline transporting methane;
- Boiler blast;
- Explosion of transformer;
- Short circuit in electric cables may result in fires;
- Electrocution i.e. electrical incident resulting in a fatality;

- Chemical hazards;
- Structural Collapse.

10.5.1 Natural Hazards

The project area is prone to several types of natural hazards which might affect operational activities of the Project and the same are as listed below:

Floods as an emergency

The location of Ashuganj on the low lying flood plains of Meghna also makes it susceptible to monsoon and flash floods.

Earthquake as an emergency

The location of Ashuganj falls in Zone II, it has seismic coefficient of 0.05 g and the shocks of intensity of VIII are possible.

Lightening

The area is also susceptible to lightening emergency during monsoon season.

Other Emergencies

The facility may experience Social Unrest as an emergency in case of following situations:

- Unsafe and unhealthy working conditions provided to workers;
- Non-payment of wages and disrupted terms of employment;
- Discrimination between local and migrant workers on various grounds (recruitment, benefits, accommodation, equal opportunity etc.);

10.6 Emergency Classification

Severity of accident and its likely impact area will determine the level of emergency and the management plan required for appropriate handling of the emergency. Emergency levels and the action needed for each level are indicated below:

10.6.1 Level 1 Emergency

A local accident with a likely impact only to immediate surroundings of accident site, such as, local fires and limited release of toxic or inflammable materials is considered as Level 1 Emergency. The impact distance may not be more than 250 m from the site of primary accident and may require evacuation of the building/area where accident occurred and utmost the adjacent buildings. At the proposed facility, minor fires may cause level 1.

10.6.2 Level 2 Emergency

A facility level accident with impact distance up to 1000 m for potential threats to life and property requiring the evacuation of all workers and staff except the emergency response personnel. The

demarcated limited area outside the facility may also have to be evacuated. Fires accompanied by small explosions may belong to emergency Level 2. At the proposed facility, fire and explosions due to leakage of gas can be considered as Level 2 Emergency.

10.6.3 Level 3 Emergency

An accident involving a very serious hazardous situation and with likely impact extending well beyond the facility boundary limit, such as, major fire, very large release of inflammable material and explosion of large quantity of explosive materials. Major fires will usually have the triggering effect resulting in the propagation of explosion. In a Level 3 emergency, evacuation of surrounding population around the facility periphery up to a distance of 1000 m may sometime become necessary.

10.7 Organization Structure

This section provides the organizational framework suggested to handle different emergencies and identifies the key personnel that will be responsible for managing any emergency situation. The Team will have the following role:

- Control the emergency and render the site safe by the application of local resources; and
- Support the local response effort by co-ordinating additional equipment, personnel, and other external resources for the direct response effort.

The emergency response team will be headed by Site Incident Controller and will comprise of following personnel:

- Fire/ Safety Officer;
- Evacuation Officer;
- Communication Officer and;
- Medical Officer.

Roles and responsibilities of the team are as described in subsequent sub-sections.

10.7.1 Site Incident Controller (SIC)

The Site In charge will act as Site Incident controller who will supervise the members of Emergency Response Team. The responsibilities of SIC are enumerated below:

- Set up Emergency Control Centre (ECC) to direct emergency operations with the help of other team members;
- Determine the severity of an emergency; declare appropriate emergency level and changing the emergency level, if considered essential;
- Marking of Safe Assembly Zones (SAZs) within the site in consultation with Evacuation Officer and informing all the employees present at the site;
- Determine most probable course of events by continuously reviewing and assessing the developments;
- Direct the safe shutting down of operations in consultation with other officers, if necessary;

- Ensure proper evacuation and treatment to injured personnel;
- Liaison with Police, Fire Brigade and other agencies, if required;
- Look after safe operation of the facility and rehabilitation of affected persons; and
- Declare all clear situations after the emergency is over.

10.7.2 Fire/ Safety Officer

- Reports to Site Incident Controller and assist him in all matters;
- Arrange first aid to the casualties and other emergency equipments;
- In post-accident conditions, gather information on the material /equipment involved in the accident and its danger potential, its effect on humans and environment;
- Assist Site Incident Controller in maintaining the emergency equipment and in conducting / evaluating mock drills; and
- All the fire fighters shall work under his guidance at the time of emergency.

10.7.3 Evacuation Officer

- Proceed to emergency area and report to Site Incident Controller and acts as per the instructions;
- Consult the Safety Officer of the site for evacuation of the employees;
- Advice all the employees expect emergency response team to assemble at safe assembly zones (SAZ);
- Perform head count at SAZ and shall record names;
- Proceed to the emergency area and report to Site Incident controller after getting the information regarding emergency.

10.7.4 Communication/ Liaison Officer

- Proceed to the Emergency Control Centre and report to the Site Incident Controller as soon as possible after receiving information;
- Co-ordinate with all the outside agencies who offer assistance to an emergency response supporting team;
- Keep information of the various agency representatives and where and how to contact them;
- Ensure that casualties received adequate attention and the alternate transport, when in need;
- When emergency is prolonged he shall co-ordinate with evacuation officer to arrange for the relief of rescue or fire fighting personnel and organize refreshments or catering facilities;
- Inform the residents of the adjacent area and responsible for their evacuation, if situation warrants.

10.7.5 Medical Officer

- On receipt of information, remain prepared and alert his staff to attend serious and urgent cases;
- Responsible for providing first aid to those injured/ rescued and making that they are promptly transported for further treatment, if required;
- Arrange for medical supplies at the site.

10.8 Emergency Control Centre (ECC)

The ECC will be the focal point in case of an emergency from where the overall operations to handle the emergency are directed and coordinated. It will be located outside the area of potential hazards and easily approachable.

The ECC should have the following resources available:

- Copies of the ERP;
- Layout plans showing all entry/ exit points;
- Information regarding Safety Equipment, Fire Fighting material;
- A list of telephones of key and essential staff of the company along with their residential numbers;
- Copies of the local Telephone Directories (latest);
- A list of important telephone numbers like neighbouring premises / industries, Fire Brigade, Hospitals;
- List of Personal Protective Equipment (PPE);
- First – Aid Kit;
- Communication equipment –Internal and External telephones and other communication equipment;
- Requisite stationary items;
- Personnel to act as messengers.

The communication equipment must be checked periodically to ensure that they are functional. The ECC should be capable of being activated within a few minutes upon declaration of an emergency.

10.9 Emergency Management

In case of all emergencies, the Emergency Response Team will swing into immediate action without losing time in order to save human life, to mitigate the impact on the environment and to safeguard commercial consideration of the project and the community. The response to an emergency situation will be as per the following five phases:

- Discovery and Notification: An event with an imminent threat of turning into an accident must first be discovered and notified to the Site Incident Controller, who will eventually inform Safety Officer.
- Evaluation and Initiation of Accident Control: Based on the evaluation of available information, the Safety Officer will make a rapid assessment of the severity of the accident and initiate the best course of action.
- Suppression and Counter Measures: Action will first be taken to contain and control the accident by eliminating the causes which may lead to the spread of accident. Measures are also taken to minimize the damage to personnel, property and environment.
- Clean-up and Disposal: After the accident is effectively contained and controlled, the clean-up of the site of the accident and safe disposal of waste generated due to the accident are undertaken.

- Documentation: All aspects of accidents, including the way it started and progressed as well as the steps taken to contain and the extent of the damage and injury, must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment. It may be noted that some aspects of documentation, such as, photographs of the site of accident and main objects involved in the accident, survey for damage estimation, etc. may have to be carried out before the clean-up and disposal phase. However, the effort in all cases is to recommence the operation as soon as possible.

10.10 Reporting Incidents and Accidents

All accidents and near-miss incidents shall be investigated to determine what caused the problem and what action is required to prevent a recurrence. Employees required to perform investigations shall be trained in accident investigation techniques. The incident/accident investigation should be a fact-finding exercise rather than faultfinding. The investigations will focus on collection of evidence to find out the "root cause" of the incident. The recommendations of the investigation report are implemented in phases.

10.11 Response Evaluation, Testing and Updating of the plan

Formulation of an ERP cannot possibly be an end by itself. It needs to be tested by holding of periodical mock emergency simulation and drill. Any shortcomings revealed during such exercise should thereafter be corrected by amending the plan. The plan should be for times to come; hence it must be reviewed at periodic intervals. The plan should be also reviewed and updated when:

- Major alteration or extension of existing facilities is carried out;
- Major change in habitation or land use of the neighbourhood takes place;
- Important telephone numbers used are altered, facilities are changed.

Mock drills should be conducted periodically for ensuring its efficiency during emergency as well as for refinement and updation. These drills based on the plan will help achieve its objectives of the ERP.

10.12 General Requirements

This section establishes the general requirement to counter any level of onsite emergency for the proposed project.

Construction of exit Routes: The number of exit routes should be adequate based on the number of employees, the size of the building, its occupancy, and the arrangement of the workplace. The width of exit routes must be sufficient to accommodate the maximum permitted occupant load.

Safe Assembly Area: safe assembly area to be identified and to be marked and communicated to all the employees working within the facility.

Medical services and first aid: It will be ensure by the project management that medical personnel are ready and available for advice and consultation on the overall employee safety and health

condition in the workplace. Trained personnel and adequate first aid supplies will be provided to render first aid when a medical facility is not in near proximity to the workplace. In case of likely exposure to injurious or corrosive materials, suitable facilities for immediate emergency use will be provided.

Portable fire extinguishers: Portable fire extinguishers based on the class, size, and degree of workplace fire hazards will be selected and distributed. The extinguishers will be mounted, located, and identified so that they are readily accessible in an emergency and employees are not subjected to potential injury.

Warning alarm systems: A distinctive and perceivable alarm system for emergency action or safe evacuation will be provided.

Personal Protective Equipment: The workplace will be assessed for hazards that are present or likely to be present. Select and ensure the use of PPE based on the workplace assessment. It should be verified that each affected employee has received and understood the required training through a written certification. Employees/workers must demonstrate the ability to use PPE prior to performing work requiring its use.

Hazard Communication: A hazard communication program should be developed and implemented. It is to be ensured that material safety data sheets for each hazardous chemical used and the hazard communication program are available to workers in the workplace.

Emergency Contact Numbers: An Emergency Contact List (the closest ambulance service, hospital or other source of medical attention, police, fire department, and emergency squad (if any) including reporting instructions to be conspicuously posted to facilitate prompt communication.

Emergency Action Plans: Specific emergency action plans needs to be prepared for each identified emergency. At a minimum, the plan must include

- Escape procedures and escape routes;
- Procedures for those who remain to conduct critical operations prior to evacuation;
- Procedures to account for employees after evacuation;
- The rescue and medical duties of employees;
- The fire and emergency reporting procedures, and
- Who to contact for further information or explanation about the plan.

The Emergency Action Plans will be communicated to all workers and systematically reviewed and updated but not less than every 6 months.

Training Programs: Following training are proposed to be imparted to the employees, including members of ERT on periodic basis:

S. No	Training	Description	Frequency
1	Mock Drills	Training on handling fire emergency situations and medical emergencies. Training consideration should include the following:	Quarterly

		• Action to be taken in event of fire; • Portable fire extinguishers; • Familiarity with Plant; • Care and maintenance of equipment or machinery being operated; • Alarm; • Permit system; • Flammable liquids. Train employees to evacuate the building immediately at the proper alarm/ signal. All employees should recognize the evacuation signal and know the exit route they are to follow. Upon hearing the signal, they should shut off equipment and report to a pre-determined assembly point. This point generally will be located outside of the building. Primary and alternate routes should be established and all employees should be trained to use either route.	
2	Awareness Program for Community	Awareness program for Sonarampur village residents on emergency response procedures	Bi-annually

10.13 Emergency Contact Numbers

Emergency contact numbers for the facility are listed below:

- Fire Service & Civil Defence: +88-08528-74220, +8801730-002480
- Police Station & Control Room: Officer in Charge +8801713373732 & Duty Officer +8801714584348
- Day-Night Diagnostic Centre: +8801731313130
- Ambulance: +8801711124247 (Day-Night Hospital & Diagnostic Centre).

11. DISCLOSURE AND GRIEVANCE REDRESSAL

Disclosure of Information and Grievance Redressal are important components of transparency and accountability that a project proponent should maintain with its stakeholders which in turn, would benefit in the improvement of project implementation and strengthen development outcome. World Bank as per its World Bank Environment Assessment Policy (OP 4.01) recognizes that in all Category 'A' projects, the stakeholders are required to consult formally twice with the stakeholders, one, in a meeting held during the screening and scoping stage and second, when a draft EIA has been developed.

11.1 Information Disclosure

The project being categorised as 'Category A', UAEL is required to undertake the requirements as set down by the World Bank Guidelines on Information Disclosure. UAEL has undertaken both the requirements by holding a public hearing within the complex of APSCL, Ashuganj on 22nd March 2014 wherein notices of the public hearing were advertised on 13th March 2014 in two national newspapers, one, The Dhaka Tribune and second, The Daily Samakal. Besides these notices, announcements and information were extended to the local communities residing within the vicinity of the project site, NGOs working in the area, opinion leaders and local governing units via discussions held during the socio-economic survey exercise and focus group discussions.

A total of 27 attendees attended the public hearing held within the premises of ASPCL. Details of the public hearing have been provided in Section 5.4.8 of the report.

The second requirement of formal consultation as per World Bank Guidelines on Information Disclosure relates to the disclosure of the draft EIA report once the report has been produced. This requirement has been partially fulfilled wherein the summary of the draft EIA report and Executive Summary have been translated in the local language (Bangla) and uploaded on UAEL's website for public viewing. In addition, UAEL is required to publicise the report in a public place in Ashuganj (e.g. Ashuganj Union Parishad Office) by translating the report in local language for the common understanding of the local population and submitting a copy of the same to the Union Parishad Office.

The following documentation is required to be made available to the public and NGOs around the project area under Ashuganj Union Parishad and displayed on the website and in hard copies:

A) Summary of the Project
B) Summary of the Environmental and Social Management Plan (ESMP)

Besides, these above mentioned documents, a gist of the following plans in local language is also required to be disclosed to the various stakeholders who are directly and indirectly impacted by the project activities whenever a need arises.

- Occupational Health and Safety Plan
- Emergency Response Plan
- Green Belt Development Plan

- Stakeholder Engagement Plan
- Grievance Redressal Mechanism
- Environmental and Social Management Plan

Consequently, once these activities have been undertaken and UAEL formally transfers the EIA Report to the Bank, UAEL is required to provide an endorsement letter to World Bank giving them the permission to post the report on their Info Shop for public disclosure and awareness purposes.

11.2 Grievance Redressal

Grievance Redressal Mechanism (GRM) is an important criterion for development projects wherein ongoing risks and impacts of projects are probable. The GRM provides a way to reduce risks for projects, offer communities and workers an effective avenue for expressing concerns and achieving remedies and promote a mutually constructive relationship.22 It is an important tool through which the affected communities and workers concerns and complaints are registered and addressed. This mechanism is a significant pillar of the stakeholder engagement process as it creates opportunities for the project proponent and communities to identify problems and determine solutions together. The mechanism tends to meet the requirements of stakeholder engagement process, prevent and address community and workers concerns, reduce risk, and assist the processes that create positive social change. A well-functioning grievance mechanism contains the following elements:

- Provides a predictable, transparent, and credible process to all stakeholders, resulting in outcomes that are seen as fair, effective, and lasting;
- Builds trust as an integral component of broader community relations activities and between employees;
- Enables more systematic identification of emerging issues and trends, facilitating corrective action and community engagement.

The GRM prepared by AECOM has been developed with an intention of it being an effective tool for early identification, assessment and resolution of complaints during project implementation. It is a means through which acceptance, assessment and resolution of community and workers complaints concerning the performance or behaviour of the project proponent, its contractors and employees are ascertained and addressed. The GRM prepared should be implemented to the entire life cycle of the project prior to the construction phase. Consultations, communication and disclosure of this plan are mandated by World Bank as per World Bank's Approach to Grievance Redress in Projects (Dispute Resolution and Prevention).

11.2.1 Grievance Mechanism Principles

Grievance Mechanisms will respond to the project needs if they are developed early in the project cycle as a measure to anticipate rather than respond to the rise of apprehension with surrounding communities. As per WBG's Good Practice Note on Addressing Grievances from Project-Affected

[22] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by The Office of the Compliance Advisor/ Ombudsman for IFC and MIGA, 2008.

Communities, September 2009, five principles have been recommended to ensure that the mechanism becomes acceptable to the communities. The five principles relate to:

- Proportionality: Scaled to risk and adverse impact on affected communities
- Cultural Appropriateness: Designed taking into account culturally appropriate ways of handling community concerns
- Accessibility: Clear and understandable mechanism that is accessible to all segments of the affected communities at no cost
- Transparency and Accountability: To all stakeholders
- Appropriate Protection: A mechanism that prevents retribution and does not impede access to other remedies

11.2.2 Approach to Grievance Redress

World Bank in its "Approach to Grievance Redress in Projects" has proposed three interlinked steps of Grievance Redress. The steps are provided in the following:

- A risk-based assessment of potential grievances, disputes or conflicts that may arise during project preparation and implementation
- Identification of the client's existing capacity for grievance redress
- An Action Plan that identifies priority area for strengthening grievance capacity, or if necessary, establishing new mechanisms at the project level.

11.2.3 Process involved in an Effective Grievance Management

An effective grievance management encompasses a step by step process which is necessary along with competent personnel for proper completion of grievances handled. WBG's Good Practice Note on 'Addressing Grievances from Project Affected Communities' highlights five steps which should be considered in implementing an effective grievance mechanism. The five process steps have been detailed in the following,

- Publicizing Grievance Management Procedures: An effective grievance mechanism can be determined by how popular and accessible it is to the stakeholders. By publicising the grievance mechanism in line with the cultural characteristics and accessibility factor, the success of its acceptability can be determined among the stakeholders.
- Receiving and Keeping Track of Grievances: Once publicising of the grievances mechanism is undertaken the project proponent should have the capacity of collecting grievances, recording, registering and tracking them throughout the processing cycle to reflect their status and important details.
- Reviewing and Investigating Grievances: A successful grievance mechanism reflects the transparency and speed by which it records, registers and addresses the grievances.
- Developing Resolution Options and Preparing a Response: Once acknowledgment and understanding of the grievances is done, resolution options to commensurate with the nature of grievances by considering community preferences, project policy, past experiences, current issues and potential outcomes is to be developed.

- Monitoring, Reporting and Evaluating a Grievance Mechanism: The tools of monitoring and reporting are important components for measuring the effectiveness of the grievance mechanism. Monitoring helps identify common or recurrent claims that may require structural solutions or a policy change, and it enables the project proponent to capture any lessons learned in the resolution of grievances.

11.2.4 Steps for Developing a Grievance Mechanism

UAEL while developing the Grievance Mechanism is required to adhere to the following steps:

- Development of Procedures: UAEL should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Chief Grievance Officer at Corporate level and Grievance Officer at Site level) who will be responsible for receiving and addressing the grievances at the site level and handle the cases at the escalation level. The procedures to be developed should include assessment procedures, procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.
- Develop Resolution Options and Response: Once UAEL has developed procedures, formal and informal resolution options should be developed along with preparation of formulating a response. General approaches to grievance resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using a third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.
- Publicise the Grievance Mechanism: Once the procedures for Grievance Mechanism has been developed by UAEL, it has to be publicised through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan. UAEL should inform the local community in the first instance and then on remind them of this mechanism on a regular basis during the project construction and operation phases. In addition, information on the GRM should also be disseminated to the direct and indirect workers on a regular basis. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updation.
- Training/ Workshops on Grievance Redressal Mechanism: A separate training/ workshop should be undertaken by UAEL at the community and worker level to discuss the process of how a grievance gets registered, the local contact person's/grievance officer details of receiving grievances, the significance of grievance boxes, the timelines for addressing the grievances and the personnel involved in the redressal process. These trainings should be held every half yearly and feedback/suggestions from the community and workers should be acknowledged and changes to the GRM should accordingly be undertaken to make it more user friendly.
- Recording of Grievances: Once the stakeholders are aware of the mechanism and access it to raise grievances, UAEL is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, UAEL is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the

identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasising the records and status of the grievance is to be maintained by the identified Grievance Officer at the site level. The Grievance Log can be used to analyze information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that the project proponents might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.[23]

- Appeal: If the grievance redressal solution is not acceptable or agreed by the project proponent, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by UAEL so that social accountability and transparency is promoted by them in every step. National Court or convening of a senior and independent panel of individuals to seek appropriate resolution of the case with representation from both government and civil society is often encouraged. This panel may also play the role of providing strategic oversight and assurance of the mechanism through review monitoring and tracking data.
- Resolve and Follow Up: Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close the case accordingly. UAEL is required to provide regular (quarterly) reports to the public and workers that track the number of complaints received, resolved, not resolved and referred to a third party. In addition, the funding agencies also need to be constantly apprised of the quarterly reports in order to support UAEL in early identification of developing risks.

11.2.5 Proposed Grievance Redressal Mechanism for UAEL

UAEL in order to implement the Grievance Redressal Mechanism is required to identify the contact person/ grievance officer involved at the site level for registering the grievances, the process of registering and action taken thereon for the resolution of the grievance, the timeline required in each step and criteria in escalation of the case to the higher level.

A two level approach is proposed to be developed for all cases of grievances. As per the severity of each case, resolution of the grievances can be undertaken at each level. The steps of grievance redressal for UAEL have been provided below:

Receive and Register a Complaint

- Any worker/ stakeholder with concerns pertaining to onsite work such as occupational health and safety, terms of employment, wages paid, issues with community or among co-workers, management etc. may register their complaint in writing to the nominated person/grievance officer at site (Level-I);
- Secured grievance boxes shall be placed at various identified location within the site area, site office and community level ;

[23] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by The Office of the Compliance Advisor/ Ombudsman for IFC and MIGA, 2008.

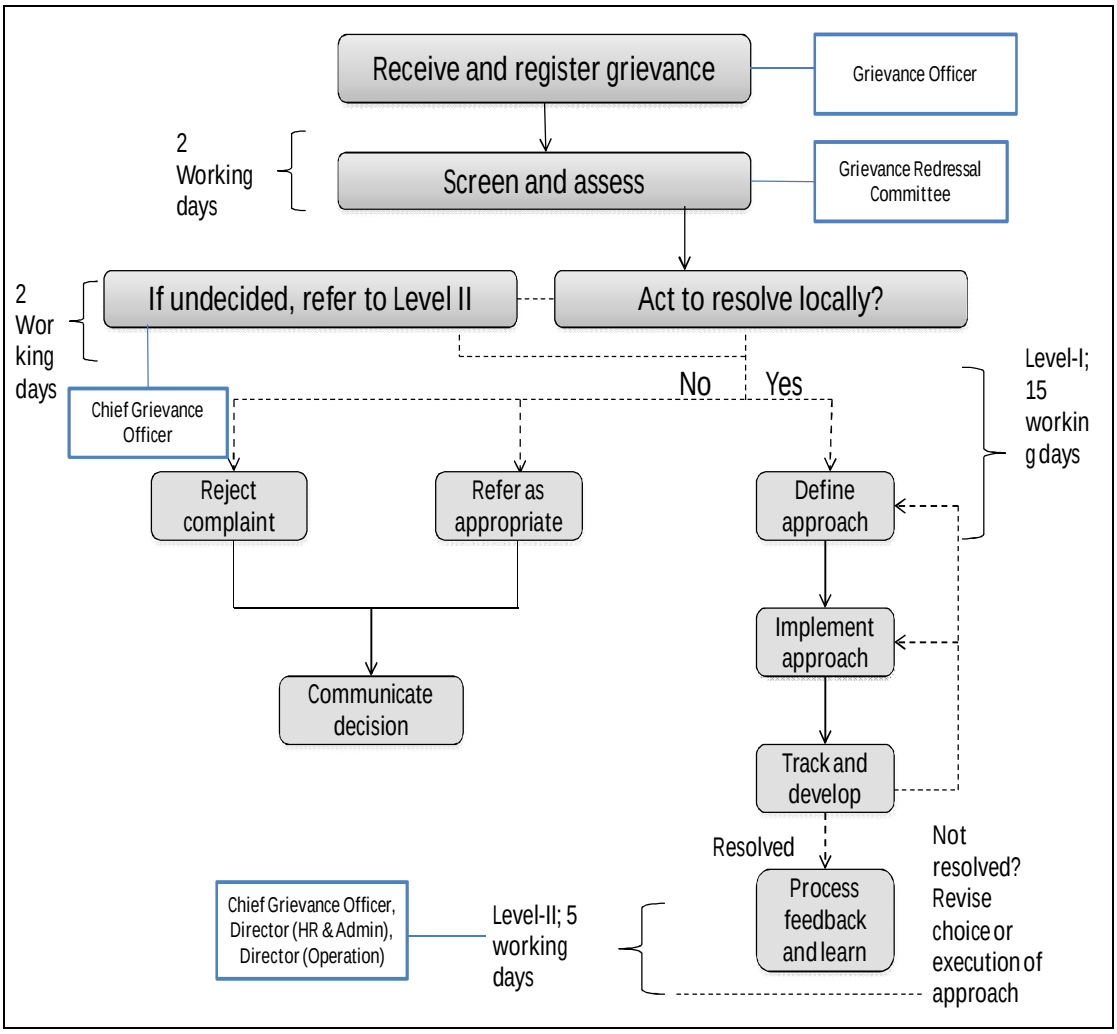
- If the complainant wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint boxes;
- Once a complaint has been received it shall be recorded in the grievance log register or data system and an acknowledgement slip is provided to the complainant;

Assessment and Addressal of Complaint

- The identified Grievance Officer at Level I will open the complaint boxes every fifteen (15) days and forward the grievances to the Plant Manager for further action. In addition, in turn of physical receipt of compliant, the same will be forwarded to the Plant Manager;
- The grievance will be assessed to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not;
- During the assessment of complaints, the team at Level I comprising the Grievance Redressal Committee (in cases concerning Contract Workers then Contractor Site Supervisor would also be involved) will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved. The GRC will comprise of the Chairman of Ashuganj Union Parishad, Project Manager- UAEL, Plant Manager – UAEL, Plant Manager – UAEL, Electrical Engineer – UAEL and Safety Officer – UAEL.
- If no decision is made within 2 days by the Committee at Level I, the issue will be forwarded to the Chief Grievance Officer based at the Corporate Office (Level II) to screen and assess the grievance. If the complaint seems to require intervention then it will be considered for further action, otherwise it will be rejected and the same will be communicated to the concerned complainant by the Grievance Officer based at the site level within 2 working days;
- The grievances will be addressed at the Level-I by the GRC and Contractor Supervisor (in cases involving contract workers) within 15 working days;
- If the grievance fails to be addressed at Level-I within stipulated time period or to the satisfaction of complainant, the grievance will be referred to the Chief Grievance Officer (Level – II) to take the final decision pertaining to the complaint;
- At this level, the Chief Grievance Officer (identified by the Company) will discuss the issue with the Director (Human Resource & Administration) and Director (Operation) and try to address the grievance. The Chief Grievance Officer shall provide support in terms of decision making. If necessary, meetings will be conducted with the complainant and evidence will be examined. The grievance will be closed within 5 working days of referral;
- The worker/ complainant will have the opportunity to be present at the committee meetings and discuss the grievance at both the levels if the grievance remains unresolved even after going through both the levels, the complainant will have the option to approach the appropriate court of laws for redress.

The Grievance Mechanism proposed for UAEL to consider and implement have been provided in Figure 11-1.

Figure 11-1: Proposed Grievance Mechanism Structure for UAEL



Source: Adapted from CAO's Guide to Designing and Implementing Grievance Mechanisms for Development Projects

11.2.6 Resources required for Grievance Mechanism Implementation

A Grievance Mechanism becomes successful if adequate resources are assigned in its implementation. Adequate resources here refer to people, systems and processes and associated financial resources. In order to incorporate the responsibility of designing, implementing and monitoring the grievance mechanism, the senior management at the corporate level of UAEL should be involved in executing the various tasks.

Responsibility

For a grievance mechanism to function effectively, it is important to establish a governance structure and assign responsibilities for the mechanism's implementation. The following roles and responsibilities have been identified for grievance mechanism implementation:

Chief Grievance Officer (Corporate Level/ Level II): A Chief Grievance Officer is to be nominated at the corporate level. The incumbent is to have some knowledge in Social Sciences and have more than 13-15 years of experience working including possessing prior knowledge of Grievance Redressal

Mechanism and its Management. He is to report directly to the Managing Director of UAEL and work in tandem with Director of Human Resource & Administration and Director of Operation based at the corporate office.

Grievance Officer (Site Level/ Level I): A Grievance Officer is to be nominated at the site level. The incumbent is to have prior knowledge of handling grievance cases. He is to report directly to the Chief Grievance Officer based at the Corporate Level as well as the Plant Manager at the Site Level. The Grievance Officer is to work in tandem with the Electrical Engineer. They cumulatively (along with the Chairman, Ashuganj Union Parishad) form the Grievance Redressal Committee at the site level. In cases of grievances from contract workers, the Contractor Supervisor will also join the Grievance Committee and take part in the discussion and resolution of grievances.

A Grievance Redressal Committee has been formed at the Site Level. It is imperative to mention here that to maintain ultimate transparency and accountability for the grievance mechanism process third parties which are neutral and independent have also been included within the structure. To realize these criteria, one member from the local administration and public representative side has been identified by UAEL to be a part of the GRC, namely, the Chairman of Ashuganj Union Parishad. He has been nominated as the Chair Person of the GRC and he is responsible in chairing the meetings whenever any grievances come to the notice at Site Level.

The list of members to be included within the GRC has been provided in (Table 11-1).

Table 11-1: List of Members of Grievance Redressal Committee

S.No.	Members	Role
1	Md. Mubarak Hossen, Chairman of Ashuganj Union Parishad	Chair Person & Head of the Grievance Redressal Committee
2	Md. Jamirul Karim, Project Manager, UAEL	Member Secretary
3	Tareque Uddin Ahmed, Plant Manager, UAEL	Chief Grievance Officer of UAEL
4	Md. Dewan Alam, Electrical Engineer, UAEL	Member
5	Kamrul Ahsan, Safety Officer, UAEL	Member

Source: ESIA Report submitted by Adroit Environment Consultants Ltd (AECL)

11.2.7 Levels of Grievance Redressal

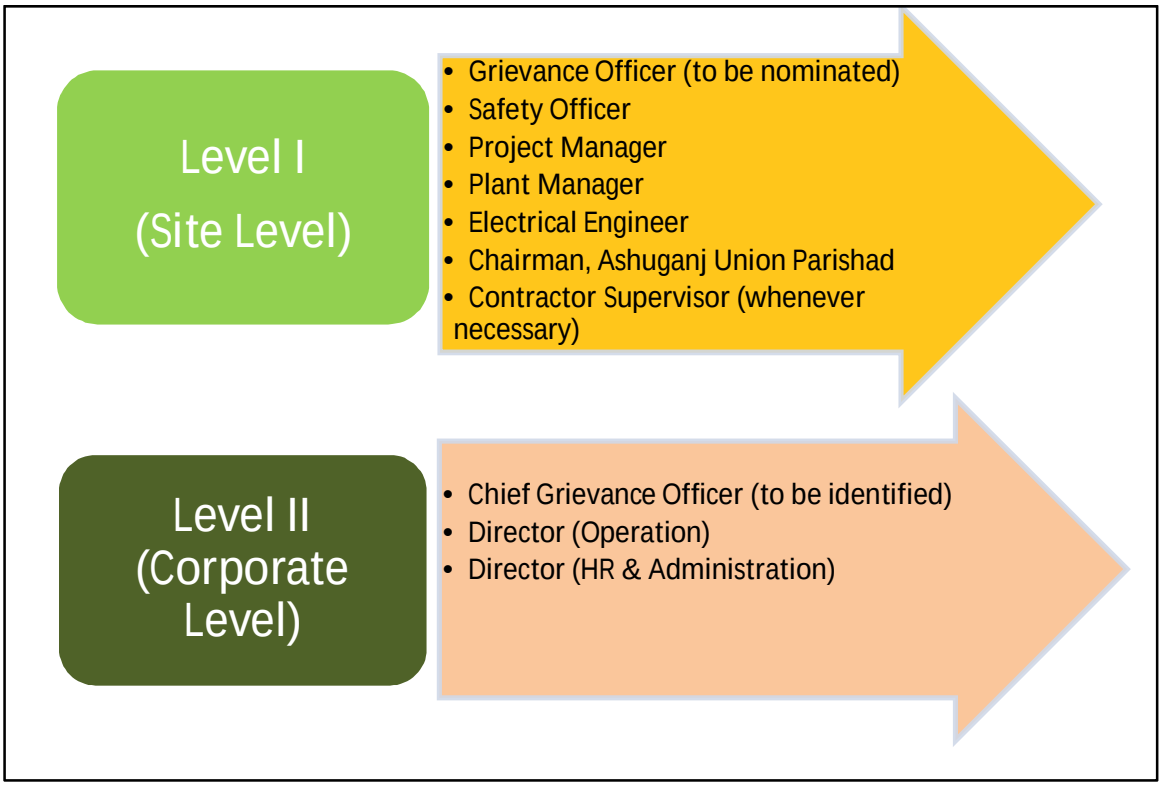
A two tier approach has been proposed in the redressal of grievances. All grievances are to be resolved within these two levels depending upon the severity and gravity of the grievances. The representatives proposed at different levels of grievance committees are provided in Figure 11-2.

11.2.8 Engagement of Third Party

To maintain ultimate transparency and accountability for the grievance mechanism process, third parties such as non-governmental organizations (NGOs), local community etc. can at times be involved in the grievance redressal process. These parties can serve as process organizers, places to

bring a complaint to be passed on to the company or as facilitators, witnesses, advisors or mediators. Third parties can assist in enhancing the trust level from communities as well as overcome limitations of project-level mechanism.

Figure 11-2: Two Level Approach of Grievance Committee



Through the involvement of third parties as facilitators, the community's confidence in project level grievance mechanism can be increased and the project proponent can gain a better reputation with and greater trust from stakeholders. In addition, cost-efficiency and supplement of internal resources can also be achieved if this step is contemplated upon.

Engagement of Third Parties in UAEL's GRM: To maintain transparency and accountability, UAEL has included the Chairman, Ashuganj Union Parishad as the Chair Person of the GRC. This will no doubt, help build the trust of the community members and the effectiveness of the project proponent's grievance mechanism will be strengthened.

11.2.9 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.[24]

[24] IFC's Good Practice Note on Addressing Grievances from Project-Affected Communities

Monitoring: Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal and external audits every six monthly based on the complexity of the nature of grievances can be adopted by UAEL. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, UAEL can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost effective manner.

Reporting: All grievances registered have to be recorded and regularly updated. The site management or Grievance Officer is responsible in discharging this responsibility and he should be able to produce this document whenever any audits take place. In addition, a monthly reporting system should be introduced wherein the Grievance Officer is required to submit a Grievance Report to the Chief Grievance Officer even if 'nil' grievances are recorded at the site level. All minutes of meetings with stakeholders, complainants and Grievance Redressal Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user-friendly.

12. DISCUSSION AND CONCLUSION

The United Ashuganj Energy Limited has approached Dhaka Bank Limited (DBL) for part financing under the World Bank (WB) supported Investment Promotion and Financing Facility (IPFF) Project. The WB has already approved the project for financing but has provided a condition to prepare an Environmental and Social Impact Assessment (ESIA) report as per the WB requirements as the EIA report prepared by Adroit Environment Consultants Ltd (AECL) to obtain environment clearance was not found in corformance to the WB requirements.

In order to achieve the objective AECOM India Private Limited (AECOM) has been engaged by UAEL to prepare an ESIA report as per the World Bank Group Operational Policies and Environmental Health and Safety guidelines.

The current ESIA study for the Project is largely based on the project specific details as provided by UAEL, discussions with community and observations from the site visits and surveys conducted. Data on air, water, soil and noise presented in baseline chapter is either provided by the client or cited from earlier ESIA report prepared by AECL in 2014 for the same project. Comprehensive social and ecological surveys were undertaken to assess these aspects.

The elevation at Ashuganj is around 6 -7 m above mean sea level and is prone to flooding. The area is characterised by the alluvium flood plain deposits and alluvial soils in the Meghna Plain are generally fertile and enriched with heavy silt deposits carried downstream during the rainy season.

The project area lies in a zone, where ground water level is less than 5.3 to 7.6 m deep and also have good availability of surface water due to its proximity of Meghna river.

The most predominant land use within 5 km radius of the site is agriculture (50 %) followed River and other water bodies (24 %), Habitation (12.6%), Barren (8%), Industrial (5%).

The annual rainfall in the area varied between 1329 mm and 2885 mm during last 10 years. The monthly average temperatures were recorded to be in the range of 17 ^{0}C during January to 30^{0}C during May and June. The monthly average wind speed varies from 2 knots to 6.3 knots in various months in last 10 years (1 kn = 0.51 m/s). Maximum wind speed is observed during the months of May and April and also during two months of September and October. The most predominant wind directions were found to be South and South East.

The existing ambient air quality of the study area was monitored at one location (down wind direction) at the plant gate between 5th and 31st March, 2015. The Pm10 concentrations were found to vary between 147 and 386 µg/m^3, while PM 2.5 was found in the range of 55.8 and 196 µg/m^3. Bothe the particulate matter parameters were found to be higher than the 24 hourly BNAAQ Standards. NOx although conforms to the WBG standard (0.2 mg/m^3) but was varying between 0.059 and 0.98 mg/m^3. CO levels were found to be low in the region.

Noise monitoring was carried out at 5 locations within plant and one in the APSCL residential complex. Noise levels at all the location were found to be well within standards except the location on the southern location. Higher noise levels at this location are attributed to the presence of Aggreko plant and nearby construction activities.

The recent monitoring results were compared with DoE Standards for inland surface water and it was found that water is suitable for all the purposes except for drinking without treatment as DO content is less than 6 mg/l. While the earlier results have shown that the pond water had a BOD of more than 4 mg/l and hence it is not fit for drinking without treatment and for any recreational activity. Though is good for fishing, industrial purposes and irrigation. In addition to these heavy metals were also analysed and all heavy metals were not detectable in the surface water samples.

The results of ground water monitoring show that all the parameters are in conformance with the allowable limit of drinking water as per as the Bangladesh Standards for Drinking Water (ECR'97) and WHO guidelines. Total and Faecal coliforms numbers were observed in higher numbers in the ground water samples of the project site, suggesting faecal contamination. People at the site reported to consume the ground water and have also reported water borne diseases. This is attributable to the absence of drainage system, open defecation, combined with easy percolation of contaminated water to the ground water which is available at shallow depths.

Ecology survey were conducted in the 2 km radius of the site and it was ascertained that the survey-area contains modified habitats in the form of farmlands, orchards, plantations, aquaculture ponds, habitations, village ponds, embankments, roads and jetties. The survey-area contains natural habitats, in the form of small communities or individuals of native species, distributed over patches of natural forest, marshes and natural water bodies. There were fifty-eight species of woody and thirty-three species of non-woody higher plants, comprising both native and exotic species were recorded during survey. At least sixty-eight species of mammals, one hundred and fifty-seven species of birds, seventy-two species of reptiles, ten species of amphibians and seventy-three species of fishes are likely to be resident in and around the survey-area.

The considered 'study area' for the social impact assessment also includes areas falling within 2 km radius of the project area. A total of seven villages (Sonarampur, Ashuganj, Char Sonarampur, Char Chartala, Shohagpur, Bhairab Bazar, Paltakandawere identified within the demarcated study area. Five of the villages are from Ashuganj Upzila in Bhramanbaria District and rest two are from Bhairab Upzila of Kishoreganj District. Amongst the project influenced villages, Char Chartala has the highest population with 25,789 persons while Char Sonarampur has the least, with a population of just 1508 people. The Sonarampur has a population of about 8000 people, where the project is located.

Stakeholder analysis was carried out to take a more comprehensive view of the stakeholder's group interests, how they would be affected and to what extent and influence they could have on the project. The stakeholders comprised of representative of local community, NGOs working in the area, opinion leaders and local government officials. In addition to the above consultations conducted with various stakeholders, during the socio- economic survey, a section of questions in the Interview Schedule Questionnaire for the Community regarding the perception about the project was asked to the individuals belonging to the local communities situated within 2 km radius of the project area. The respondents to these questions accounted to 41 in total. Most of the respondents were aware about the UAEL project and confirmed that land was mostly barren with a water body wherein individuals from surrounding areas used to undertake agricultural and fishing activities. They have confirmed that there is no cultural heritage/ archaeological site near the project site. Locals also suggested that with the development of APSCL complex availability of electricity had

gone up and it also has increased employment and business opportunities. Increase levels of noise and traffic were considered as negative aspects of the development.

The UAEL project is operational and hence impact assessment was carried out for operational and decommissioning phase only. It was assessed that the project has insignificant or minor impacts on account of land use, noise, water, hazardous material management etc. The moderate impacts are assessed for occupational health safety, while positive impacts were assessed for Socio-economic aspect.

The UAEL plant is located on the land parcel leased by APSCL. This land belonged to Bangladesh Railway Authority and is leased to APSCL for 99 years. The entire area leased to UAEL was mostly barren and comprised of a ditch where fishing activities were being carried out. Three fishermen with valid fishing licenses were identified and compensated as part of the agreement by APSCL with Bangladesh Railway Authority. There are no Rehabilitation and Ressettlement issues with regard to the land parcel and same has been confirmed during the stakeholder consultations. All the licensees were given the compensations and so far no grievance has been recorded in the area.

As the site is completely paved the potential for contamination of soil from any spill or leak is comparatively low. The site has been provided with paved and covered areas for storage of hazardous waste and chemicals. All hazardous waste will be disposed of to a government authorised vendor.

All the water drawn from the river will be discharged back to river, thus water availability for downstream activities will not be impacted. Moreover, rise in temperature of the river is also low. The rise in river water temperature is expected to be within the standards. Thus, it may be concluded that water drawl and hot water discharge will have minimal impacts on the water quality and aquatic life. Any residual impact will be restricted to the immediate vicinity of the outfall.

The air quality modelling using AERMOd revealed that contribution of the UAEL plant to the maximum ground level concentration for PM and NOx is 1.27 µg/m^3 and 17.62 µg/m^3, respectively. The predicted maximum ground level concentrations of $PM_{(10)}$ due to the cumulative emissions of all power plants modelled over a period one year suggest that the maximum concentration of 2.1 µg/m^3 is observed at a distance of about 240 m North of the UAEL boundary. The contribution of particulates from power generation is very limited if compared to the baseline values, which already indicates high PM levels due to all the existing power plant operations, extensive construction activity and operation of the rice mills. The predicted maximum ground level concentrations of NOx due to the emissions of all the power plants was predicted to be 26.04 µg/m^3 at a distance of about 100m North of the project boundary.

A total of 42 noise major sources are identified, wherein 20 engines, equipped with cooling radiators and exhaust fan, steam turbine and A.C Generator were considered for noise assessment. The modelling results indicate that the maximum noise levels of 80- 87 dB (A) will only be observed with in the plant premesis with out any protective measure. The maximum noise level of 87 dB(A) was observed to be at a distance of approximately 90 m from the Engine 1 in north-east direction (near the turbine location) while noise will reduce to about 70 dBA at the distance of 40 m from the location of the engine 1. It is important to note that at present one acoustic enclosure is provided for

a set of 10 engines, which reduces noise to a minimal level. The ambient noise levels measured within the plant, suggest that cumulative noise levels of the project and other commercial and residential activities are well within the noise standards.

The APSCL complex was established around 1970 and thereafter it continued to expand. Though the area was reported to have many endangered species but at present it represents modified habitat with farmlands, orchards, plantations, aquaculture ponds, habitations, village ponds, embankments, roads and jetties. The APSCL complex of 16.43 acres does not have any significant vegetation but River Meghna provides habitat to a wide range of aquatic species. The hot water discharge is not likely to have any impact on the water temperature of the river and aquatic life. There are no wildlife protection areas or ecological sensitive sites within 5 km radius of the project site. It is therefore assessed that at present, no significant impact on ecology is envisaged due to the UAEL activities.

Only 2-3 trucks may be required every month to supply consumables to UAEL, which is an insignificant increase in number of vehicles and will not cause any impact on the traffic in the area.

To identify the hazard, an ALOHA analysis of the fuel gas used for the gas turbine has been provided for the power project of UAEL. The study suggests that the highly flammable zone, blast zone and thermal radiation zones will be restricted with in the plant premises.

Although the UAEL plant is envisaged to have negeligible impact on its surrounding but a detailed Environmental and Social Managment Plan is provided to describe the mitigation measures for all the impacts associated with the project during its operation phase. The ESMP also delineated the monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during the operational phase. Additionally, detail management plans on Emergency Response, Greenbelt Development, Stakeholder Engagement, Occupational Health and Safety, and Grivance Redress are also provided.

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DISCLOSURE OF CONSULTANT

Environment and Social Impact Assessment - 200 mw Thermal Power Plant, Ashuganj, Bangladesh

Version	Date	Reviewed By	Approved By
Final Report	6 August, 2015	Ajay Pillai	Dr. Somnath Mukherjee
Draft Report – Rev 2	28 July, 2015	Ajay Pillai	Dr. Somnath Mukherjee
Draft Report – Rev 1	17 June, 2015	Ajay Pillai	Dr. Somnath Mukherjee
Draft report	20 May 2015	Ajay Pillai	Dr. Somnath Mukherjee

The following professionals were engaged in preparation of the report with specific inputs as mentioned below:

Name of Professionals	Responsibilities
Ritu Paliwal	Project Management and compilation of all Chapters; Report preparation; Contributed to write Project and process description, Baseline description, Impact Assessment; Water Quality Modelling and Management Plans
Ajay Pillai	Air Quality Modelling
Rashmi Dutta; Sunila Sahasrabudhe	Baseline Analyses; Emergency Response Plan; Occupational Health and Safety Plan
Susan Janet Vauquelin; Pallavi Ranjan	Social Consultations and Impact Assessment; Disclosure And Grievance Redressal Plan; Stakeholder Engagement plan
Deepti Bapat	Ecological Assessment
Jayakrishna Vasam	Land Use Mapping
Anchal Jain	Legal, Policy and Administrative Framework, Analyses of the Alternatives; Noise Modelling
Satyanarayan Nayak, Pranit Sai	Risk Assessment

On Behalf of AECOM India

Approved By:

Dr. Somnath Mukherjee
Executive Director
Environment, India

Annexure I

No Objection Certificate

Ashuganj Union Parishad,

Dated 12th November, 2013

আশুগঞ্জ ইউনিয়ন পরিষদ

ডাকঘর ও উপজেলা- আশুগঞ্জ, জেলা- ব্রাহ্মণবাড়িয়া।

মোঃ মোবারক হোসেন
চেয়ারম্যান
মোবাঃ ০১৭১১-৮২১৪৩৮
ফোন ঃ ০৮৫২৮-৭৪৫৫৭

সূত্র...২০৫/১৩

তারিখ: ১২/১১/২০১৩ইং

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্রের ছক

১/ আবেদনকারীর নামঃ :জনাব মাইন উদ্দিন হাসান রশিদ

২/ পিত/স্বামী/স্ত্রীর নাম :জনাব হাসান মাহমুদ রাজা

৩/ আবেদনকারীর ঠিকানা :আশুগঞ্জ (আশুগঞ্জ পাওয়ার স্টেশন সংলগ্ন, পোঃ ও উপজেলা-আশুগঞ্জ, জেলা-ব্রাহ্মণবাড়িয়া।

৪/ কারখানা/প্রকল্পের অবস্থানগত ঠিকানা: আশুগঞ্জ (আশুগঞ্জ পাওয়ার স্টেশন সংলগ্ন)।

৫/ কারখানা/প্রকল্পের তফসিল

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমির ধরণ	মোট জমির পরিমাণ
ব্রাহ্মণবাড়িয়া	আশুগঞ্জ	সোনারামপুর	১৭৮	৬৬৪ (অংশ) ২২০ (অংশ)	অনাবাদি	৬.৪৮ একর

৬/ কারখানা/প্রকল্পের উৎপাদিত/উৎপাদিতব্য পণ্যের নাম: বিদ্যুৎ

উপরোক্ত তথ্যাদির আলোকে ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ কারখানা/প্রকল্পে নিম্নবর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো।

শর্তাবলী

১/ প্রকল্প/কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষন আইন ও বিধি যথাযতভাবে অনুসরণ করতে হবে।

২/ পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে।

৩/ কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।

৪/ উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫/ বায়ু ও শব্দদূষণ করা যাবে না।

৬/ কারখানা/প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ:১২-১১-২০১৩খ্রিঃ

মোঃ মোবারক হোসেন
চেয়ারম্যান
আশুগঞ্জ ইউনিয়ন পরিষদ
আশুগঞ্জ, ব্রাহ্মণবাড়িয়া।

Ashuganj Union Parishad

Post Office & Upazilla – Ashuganj, District - Brahmanbaria

Md. Mobarak Hossen
Chairman
Mobile: 01711821438
Phone: 08528-74557

Date: 12/11/2013

No Objection Certificate for Site/Environmental Clearance Certificate from Local Authority

1. Name of Applicant: Mr. Moinuddin Hasan Rashid
2. Name of Father/Husband/Wife: Mr. Hasan Mahmood Raja
3. Applicant's Address: Ashuganj (Beside Ashuganj Power Station)
   PO & Sub-District – Ashuganj, District – Brahmanbaria
4. Industry/Project's Location Address: Ashuganj (Beside Ashuganj Power Station)
5. Industry/Project's Schedule:

Name of District	Name of Police Station	Name of Mouza	Khatian No.	Daag No.	Type of Land	Total Area of Land
Brahmanbaria	Ashuganj	Shonarampur	178	664 (Part) 220 (Part)	Nonagriculture	6.48 acres

6. Product of the Industry/Project: Electricity

In light of the above information, United Ashuganj Energy Ltd. is being granted the No Objection Certificate under the following terms & conditions:

Terms & Conditions:

1. The Environmental Conservation Rules must be followed during construction and operation of the project/industry
2. The Clearance must be collected as per the rules and regulations of the Department of Environment.
3. Health and safety of the labors must be ensured
4. Adequate fire extinguishing arrangements must be kept and in case of fire or any accidents there must be arrangements for emergency exits
5. No air and noise pollution
6. The liquid effluent from the industry/project cannot be discharged outside without being treated.

It is to be noted here that in case of a breach in any of the terms and conditions the competent authority can take legal action against the industry/project.

Date: 12-11-2013

Sd/ & Sealed. Md. Mobarak Hossen
Chairman
Ashuganj Union Parishad

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
চট্টগ্রাম বিভাগীয় কার্যালয়
জাকির হোসাইন সড়ক, খুলশী, চট্টগ্রাম-৪২০২।
www.doe-bd.org

স্মারক নম্বরঃ পঅ/চবি/ছাড়পত্র-০৭/২০১৪/ ১০৭

তারিখঃ ০৭ /১০/১৪২০ বঙ্গাব্দ
২০ /০১/২০১৪ খ্রিস্টাব্দ

বিষয়ঃ ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, আশুগঞ্জ ২০০ মেঃ ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট এর অনুকূলে অবস্থানগত ছাড়পএ প্রদান ।

সূএঃ- পরিবেশ অধিদপ্তর, ব্রাহ্মণবাড়িয়া জেলা কার্যালয়ের ০২/০১/২০১৪ তারিখের পএ, স্মারক নম্বরঃ পরিবেশ/ব্রাঃবাঃজেঃঅঃ/৫৩৮/২০১৩/০৫।

বিষয়োল্লিখিত ও সূত্রের পরিপ্রেক্ষিতে বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্পের জন্য দাখিলকৃত কাগজপত্র পর্যালোচনায় দেখা যায়, প্রকল্পটি বাংলাদেশ পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ অনুসারে "লাল" শ্রেণীভুক্ত। প্রকল্পটি বাংলাদেশ পাওয়ার ডেভেলপমেন্ট বোড (বিপিডিবি) হতে লীজ নেয়া ৬.৪৮ একর জায়গায় আশুগঞ্জ পাওয়ার প্লান্টঃ কমপ্লেক্স এর মধ্যে নির্মাণ করা হবে ।

দাখিলকৃত কাগজপএ পর্যালোচনায় দেখা যায়, উদ্যোক্তা প্রকল্পের জন্য Initial Environmental Examination(IEE), Feasibility Study Report, Terms of Reference (TOR) দাখিল করেছেন ।

যেহেতু প্রকল্পটি একটি খালি জায়গায় স্থাপিত হচ্ছে তাই প্রকল্পটির অবস্থানগত ছাড়পত্র গ্রহণ জরুরী। উদ্যোক্তার আবেদনসহ নিম্নবর্ণিত কাগজপত্রসমূহ বিধি মোতাবেক প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য এতদসঙ্গে প্রেরণ করা হলো।

১। ছাড়পত্রের আবেদন ফরম-১কপি।
২। ৫,০০,০০০/- টাকার ট্রেজারী চালান।
৩। স্থানীয় কর্তৃপক্ষের অনাপত্তিপএ -১কপি।
৪। লোকেশন ম্যাপ-১কপি।
৫। ব্রাহ্মণবাড়িয়া কার্যালয়ের পরিদর্শন প্রতিবেদন -১ কপি।
৬। Initial Environmental Examination(IEE)-১ কপি।
৭। Feasibility Study Report -১ কপি।
৮। Terms of Reference (TOR) -১ কপি।

(মোঃ জাফর আলম)
পরিচালক
ফোনঃ ৬৫৯৩৭৯

মহাপরিচালক
পরিবেশ অধিদপ্তর
সদর দপ্তর, ঢাকা।
(দৃঃ আঃ সদস্য সচিব, পরিবেশগত ছাড়পত্র বিষয়ক কমিটি)

স্মারক নম্বরঃ পঅ/চবি/ছাড়পত্র-০৭/২০১৪/ ১০৭

তারিখঃ ০৭ /১০/১৪২০ বঙ্গাব্দ
২০ /০১/২০১৪ খ্রিস্টাব্দ

অনুলিপিঃ সদয় অবগতির জন্য-
১। উপপরিচালক, পরিবেশ অধিদপ্তর, ব্রাহ্মণবাড়িয়া কার্যালয়, পশ্চিম মেড্ডা, ব্রাহ্মণবাড়িয়া
২। ব্যবস্থাপনা পরিচালক, ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, ইউনাইটেড সেন্টার, বাসা- NW(J)-6, রোড-৫১, গুলশান-২, ঢাকা-১২১২।

(মোঃ জাফর আলম)
পরিচালক
ফোনঃ ৬৫৯৩৭৯

Government of Bangladesh
Department of Environment
Chittagong Divisional Office
Zakir Hossain Road, Khulshi, Chittagong – 4202
www.doe-bd.org

Memo No. PaA/ChaBi/Charpatra-07/2014/37 Date: 20/01/2014

Subject: **Issuance of Site Clearance Certificate in favor of United Ashuganj Energy Ltd., Ashuganj 200 MW Combined Cycle Power Plant**

Reference: **Department of Environment, Brahmanbaria Divisional Office Letter dated 02/01/2014, memo no. Poribesh/BrahBaJeA/538/2013/05**

With reference to the above, upon review of the documents for the construction of the aforementioned power plant project it is hereby seen that the project falls under class "red" according to the Bangladesh Environment Conservation Rules, 1997.The power plant will be constructed on the 6.48 acres of land leased from Bangladesh Power Development Board inside Ashuganj Power Plant complex

Upon review of the submitted documents it is seen that the Sponsor has submitted Initial Environmental Examination (IEE), Feasibility Study Report, Terms of Reference (TOR) for the project.

As the project is being constructed on a vacant land it is important to acquire the site clearance for the project. The followings are enclosed herewith along with the Sponsor's application for your necessary actions as per rules:

1. Application Form for site clearance – 1 copy
2. Treasury Challan of BDT 5,00,000/-
3. NOC from Local Authority – 1 copy
4. Location Map – 1 copy
5. Inspection Report of Brahmanbaria Office – 1 copy
6. Feasibility Study Report – 1 copy
7. Terms of Reference (TOR) – 1 copy

Sd/Md. Zafar Alam
Director
Phone: 659379

Director General
Department of Environment
Head Office, Dhaka
(Kind Attention: Member Secretary, Committee for Environment Clearance Certificate)

Memo No: PaA/ChaBi/Charpatra-07/2014/37 Dated: 20/01/2014

Copy to (for information):

1. Deputy Director, Department of Environement, Brahmanbaria Office, Poshchim Modda, Brahmanbaria
2. Managing Director, United Ashuganj Energy Ltd., United Center, House-NW(J)6, Road -51, Gulshan-2, Dhaka-1212

Annexure II

Site Clearance Certificate

DoE, Chittagong Division

Dated 24th, February, 2014

নম্বর ০০৬৭

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

পরিবেশ অধিদপ্তর, চট্টগ্রাম বিভাগ

পরিবেশ ভবন

জাকির হোসেন রোড, ফয়'স লেক, খুলশী, চট্টগ্রাম
ফোন : ৬৫৯৩৭৯, www.doe-bd.org

[বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫-এর ১২ ধারা এবং পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭-এর ৭ বিধি অনুসারে অবস্থানগত ছাড়পত্র]

স্মারক নম্বরঃ পঅ/চবি/ছাড়পত্র- ০৭/২০১৪/ ৬৭

তারিখঃ ১২/১১/১৪২০ বঙ্গাব্দ
২৪/০২/২০১৪ খ্রিস্টাব্দ

বিষয় ঃ ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, আশুগঞ্জ ২০০ মেঃ ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট এর অনুকূলে অবস্থানগত ছাড়পএ প্রদান (শ্রেণীঃ "লাল") ।

ব্রাহ্মণবাড়িয়া জেলার আশুগঞ্জ উপজেলায় অবস্থিত ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, আশুগঞ্জ ২০০ মেঃ ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট নামক বিদ্যুৎ উৎপাদনকারী প্রতিষ্ঠানের অবস্থানগত ছাড়পত্রের জন্য ১৭/১২/২০১৩ ইং তারিখের আবেদনপত্র ও তৎপরবর্তীতে বিধি মোতাবেক দাখিলকৃত কাগজপত্র/তথ্যাদি পর্যালোচনা ও সংশ্লিষ্ট এলাকা সরেজমিন পরিদর্শনপূর্বক পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ অনুযায়ী "লাল" শ্রেণীভুক্ত বিবেচনায় সদর দপ্তরের পরিবেশগত ছাড়পত্র বিষয়ক কমিটির ৩৭৩ তম সভার ০৮ নম্বর সিদ্ধান্ত মোতাবেক নিম্নবর্ণিত শর্তে অবস্থানগত ছাড়পত্র প্রদান করা হলো-

শর্তাবলীঃ

১. অবকাঠামোগত উন্নয়নের আওতায় অন্যান্য বিষয়ের মধ্যে আইই প্রতিবেদনে বর্ণিত সকল মিটিগেশন মেজার্স যথাযথভাবে বাস্তবায়ন করতে হবে।

২. অনুমোদিত TOR-এর ভিত্তিতে প্রণীত ইআইএ প্রতিবেদন পরিবেশ অধিদপ্তরের অনুমোদনের নিমিত্তে পেশ করতে হবে।

৩. প্রস্তাবিত ইআইএ প্রতিবেদনে Baseline Information এর জন্য Primary Data ব্যবহার করতে হবে। এ লক্ষ্যে ইআইএ প্রতিবেদনে নিজস্ব লোকবল ও ইকুইপমেন্ট-এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম গড়ে তোলার বিষয়ে প্রয়োজনীয় কারিগরী ও আর্থিক প্রস্তাবনা অন্তর্ভুক্ত করতে হবে।

৪. ইআইএ প্রতিবেদনে এ কারখানা সৃষ্ট গ্যাসীয় পদার্থের নিঃসরণ (SOx, NOx, CO ইত্যাদি) এবং বস্তুকণার (Particulate Matters) নির্গমণ পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ এ উল্লিখিত মানমাত্রার মধ্যে রাখার জন্য বিস্তারিত দূষণ নিয়ন্ত্রণ পদ্ধতি, কুলিং ওয়াটার পুনঃব্যবহারের ব্যবস্থা এবং তরল বর্জ্য পরিশোধনের ডিটেইল পরিকল্পনা অন্তর্ভুক্ত করতে হবে। প্রতিবেদনে অন্যান্যের মধ্যে Spent lubricating oil, oil filter, এবং Sludge ব্যবস্থাপনার বিবরণী ও ড্রেনেজ প্ল্যান অন্তর্ভুক্ত থাকতে হবে।

৫. ইআইএ প্রতিবেদনে নিজস্ব লোকবল ও ইকুইপমেন্ট এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম গড়ে তোলার বিষয়ে প্রয়োজনীয় কারিগরী ও আর্থিক প্রস্তাবনা অন্তর্ভুক্ত করতে হবে।

৬. উদ্যোক্তা কর্তৃক ইআইএ প্রতিবেদন দাখিলের পর অএ অধিদপ্তর কর্তৃক তা পর্যালোচনাকালে প্রস্তাবিত প্রকল্পের কার্যক্রমের পরিবেশগত প্রভাব, Environmental Costs, কারিগরী ও অর্থনৈতিক সম্ভাব্যতা এর আর্থ-সামাজিক দিক বিবেচনায় গ্রহণযোগ্য বলে বিবেচিত না হলে এই ছাড়পএ বাতিল করা হবে। এর ফলে এ সংক্রান্ত সকল ক্ষয়ক্ষতির দায় উদ্যোক্তা কর্তৃক বহন করতে হবে।

৭. ইআইএ অনুমোদন না হওয়া পর্যন্ত আমদানিকৃত যন্ত্রপাতির অনুকূলে L/C খোলা যাবে না।

৮. প্রকল্পের জায়গার ভিতরে যদি কোন সরকারী খাস জমি থাকে, তবে সেই খাস জমি উন্নয়নের জন্য ব্যবহার করা যাবে না।

৯. প্রকল্প উন্নয়নের সময় প্রকল্পের চারিদিকে অস্থায়ী প্রাচীর সৃষ্টি করতে হবে যা Sound barrier হিসেবে কাজ করবে।

১০. এ প্রকল্পের কর্মকান্ডের মাধ্যমে প্রাকৃতিকভাবে সৃষ্ট নর্দমা, খাল ও নদীর স্বাভাবিক প্রবাহ কোন অবস্থাতেই বিঘ্ন করা যাবে না এবং কোন প্রকার জলাভূমি ভরাট করা যাবে না।

১১. ১-১০ এর সিদ্ধান্ত বাস্তবায়নপূর্বক পরিবেশগত ছাড়পএের জন্য আবেদন করতে হবে।

১২. পরিবেশ অধিদপ্তরের এনফোসমেন্ট টীম, পরিদর্শক ও পরিদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ প্রকল্প এলাকা পরিদর্শনকালে প্রকল্প কর্তৃপক্ষ কর্তৃক পরিদর্শন কার্যক্রমে সর্বাত্নক সহযোগিতা প্রদান করতে হবে।

১৩. পরিবেশগত ছাড়পএ ব্যতিরেকে প্রকল্প চালু করা যাবে না।

২৪/২/১৪

(মোঃ জাফর আলম)
পরিচালক
ফোন-৬৫৯৩৭৯

ব্যবস্থাপনা পরিচালক,
ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ,
ইউনাইটেড সেন্টার, বাসা- NW(J)-6, রোড-৫১,
গুলশান-২, ঢাকা-১২১২।

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

No. 0067

Department of Environment, Chittagong Division

Poribesh Bhaban

Zakir Hossain Road, Foy's Lake, Khulshi, Chittagong

Phone: 659379, www.doe-bd.org

[Site Clearance Certificate issued as per article 12 of Bangladesh Environment Conservation Act, 1995 and rule 7 of Environment Conservation Rules, 1997]

Memo No.: পঅ/চবি/Clearance- 07/2014/67 Date: 24/02/2014

Subject: Issuance of Site Clearance Certificate in favor of United Ashuganj Energy Limited, Ashuganj 200 MW Combined Cycle Power Plant (Category: Red)

In response to an application dated 17 December 2013 and subsequent submission of documents/information as per rules, seeking site clearance for the electricity generating plant of United Ashuganj Energy Ltd., namely Ashuganj 200 MW Combined Cycle Power Plant situated at Upazilla Ashuganj in the district of Brahmanbaria, on examination and site visit of the said plant area and on consideration of the plant being of Class "Red", as per Environment Conservation Rules, 1997, the committee on Environment Clearance of head quarter, in its 373rd meeting, as per resolution no. 8 hereby issues the site clearance under the following terms & conditions:

Terms & Conditions:

1. All the mitigation measures described in the IE report, covered under the infrastructural development, must be implemented accordingly.
2. The EIA that has been prepared based on the approved TOR must be submitted to the Department of Environment for their approval.
3. Primary data must be used for Baseline Information in the proposed EIA. For this purpose the EIA report must have the necessary technical and financial proposal detailing the set-up of in-house environmental monitoring system by combining the companies' own man-power and equipment
4. A detail plan to keep the level of emission of industrial exhaust gases (SOx, NOx, CO etc.) and discharge of particulate matters within the limits as mentioned in Environment Conservation Rules, 1997, by pollution control methods, cooling water reuse arrangement and liquid waste refinement, must be included in the EIA. The report must also include detail description on Used Lubricating Oil, Oil Filter and Sludge Management and Drainage Plan among others
5. Necessary technical and financial proposal must be included in the EIA in order to develop in-house environmental monitoring system, with the help of own man-power and equipment.
6. This clearance will be considered void if after submission of the EIA the concerned authority does not consider the project's social-economic aspects of the environmental impacts, environmental costs, technical and financial feasibility to be acceptable. As such the sponsor shall be liable for all losses.
7. L/Cs for imported machinery cannot be opened until the receipt of EIA approval.
8. If there is any government khas land inside the project area then that land cannot be used for project development
9. During project construction a temporary wall must be built around the project site which will act as a sound barrier.
10. During the course of project development no water bodies can be filled and normal flow of naturally occurring drain, channel and river can be disturbed.
11. Application for Environmental Clearance can only be filed upon compliance with the conditions 1-10
12. The project authority shall extend all cooperation and assistance to DoE's enforcement team, inspector and all officers authorized to perform inspection during their inspection of the project site
13. The plant cannot be commissioned without the Environmental Clearance Certificate.

Sd/Md. Zafar Alam
Director
Phone: 659379

Managing Director
United Ashuganj Energy Ltd.
United Center
House – NW (J) – 6, Road -51
Gulshan – 2, Dhaka - 1212

Annexure III

EIA Report Approval

DoE, Chittagong Division

Dated 15th May, 2014

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর,চট্টগ্রাম বিভাগ
পরিবেশ ভবন
জাকির হোসাইন সড়ক-ফয়স লেক এলাকা
খুলশী, চট্টগ্রাম ৪২০২
www.doe-bd.org

স্মারক নম্বরঃ পঅ/চবি/ছাড়পত্র- ০৭/২০১৪/ ১৫৮

২৭/০১/১৪২১ বঙ্গাব্দ
তারিখঃ ----------।
১২/০৫/২০১৪ খ্রিস্টাব্দ

বিষয় ঃ ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, আশুগঞ্জ ২০০ মেঃ ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট এর ইআইএ প্রতিবেদন অনুমোদন (শ্রেণীঃ "লাল")।

ব্রাহ্মণবাড়িয়া জেলার আশুগঞ্জ উপজেলায় অবস্থিত ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ, আশুগঞ্জ ২০০ মেঃ ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট নামক বিদ্যুৎ উৎপাদনকারী প্রতিষ্ঠানের ইআইএ প্রতিবেদন অনুমোদনের জন্য ০৯/০৩/২০১৪ ইং তারিখের আবেদনপত্র ও তৎপরবর্তীতে বিধি মোতাবেক দাখিলকৃত কাগজপত্র/তথ্যাদি পর্যালোচনা করার পর পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ অনুযায়ী "লাল" শ্রেণীভুক্ত বিবেচনায় সদর দপ্তরের পরিবেশগত ছাড়পত্র বিষয়ক কমিটির ৩৭৫ তম সভার ৭-০৩ নম্বর সিদ্ধান্ত মোতাবেক নিম্নবর্ণিত শর্তে ইআইএ প্রতিবেদন অনুমোদন করা হলো-

শর্তাবলীঃ

১. ইআইএ অনুমোদনের প্রেক্ষিতে আমদানিতব্য যন্ত্রপাতির জন্য L/C খুলতে পারবে, যাতে দূষণ নিয়ন্ত্রণ সংক্রান্ত যন্ত্রপাতি অন্তর্ভুক্ত থাকবে।
২. ইআইএ প্রতিবেদনে উল্লেখিত সকল মিটিগেশন মেজার্স বাস্তবায়ন সম্পন্ন করে পরিবেশগত ছাড়পত্রের জন্য আবেদন করতে হবে।
৩. নিজস্ব লোকবল ও ইকুইপমেন্ট -এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম গড়ে তোলার বিষয়ে প্রয়োজনীয় ব্যবস্থাপনা গড়ে তুলতে হবে।
৪. প্রকল্পের পরিবেশগত ব্যবস্থাপনার জন্য পরিবেশ বিষয়ে ডিগ্রীধারী প্রশিক্ষিত জনবল নিয়োগ করতে হবে।
৫. প্রকল্প চত্বরের সীমানাসহ ন্যূনতম ৩৩% জায়গায় অধিক পত্রবিশিষ্ট উপযুক্ত প্রজাতির ফলজ ও বনজ গাছ লাগিয়ে সবুজায়ন করতে হবে।
৬. প্রকল্পের যন্ত্রপাতি স্থাপনের লক্ষ্যে বিদ্যুৎ সংযোগ করা যাবে।
৭. তরল বর্জ্য রিসাইক্লিং ও জিরো ডিসচার্জ পরিকল্পনা দাখিল করতে হবে।
৮. সরকার অনুমোদিত 3R (Reduce, Reuse & Recycle) নীতি ও সকল প্রকার Resource Conservation Plan বাস্তবায়ন করতে হবে।
৯. পরিবেশগত ছাড়পত্র গ্রহণ ব্যতিরেকে বিদ্যুৎ উৎপাদন করা যাবে না।

১২/৫/২০১৪

(মোঃ জাফর আলম)
পরিচালক
ফোন-৬৫৯৩৭৯

ব্যবস্থাপনা পরিচালক,
ইউনাইটেড আশুগঞ্জ এনার্জি লিঃ,
ইউনাইটেড সেন্টার, বাসা- NW(J)-6, রোড-৫১,
গুলশান-২, ঢাকা-১২১২।

Government of the People's Republic of Bangladesh
Department of Environment, Chittagong Division
Poribesh Bhaban
Zakir Hossain Road – Foy's Lake Area
Khulshi, Chiittagong 4202
www.doe-bd.org

Memo No: PaA/ChaB/Charpatra – 07/2014/158 Date: 12/05/2014

Subject: EIA Report Approval of United Ashuganj Energy Ltd.'s Ashuganj 200 MW Combined Cycle Power Plant (Class: Red)

In response to an application dated 9 March 2014 and subsequent submission of documents/information as per rules, seeking approval of EIA Report for the electricity generating plant of United Ashuganj Energy Ltd., namely Ashuganj 200 MW Combined Cycle Power Plant situated at Upazilla Ashuganj in the district of Brahmanbaria, upon review of the submitted documents/information and on consideration of the plant as being of Class "Red", as per Environment Conservation Rules, 1997, the Environmental Clearance Committee, in its 375th meeting, held at their headquarter, as per their resolution no. Ga- 03, hereby approves the EIA Report under the following terms and conditions

Terms and conditions:

1. In context to the approval of EIA L/Cs can be opened for imported machinery, which shall incorporate necessary provisions for pollution control machinery.
2. Application for Environmental Clearance shall be filed after implementation of all the mitigation measures mentioned in the EIA report.
3. Necessary management system shall be taken to develop the in-house environmental monitoring system with the help of own man-power and equipment.
4. Trained official having a degree in environmental studies shall be employed to develop Environmental Management System of the project.
5. At least 33% of the area of the project, inclusive of the border of the project area, must be green zone consisting of thick leaved trees of fruits and forestry species
6. Electricity connection may be established for installation of the machinery of the project.
7. Plan for recycling of liquid waste and zero discharge shall be submitted.
8. Government approved 3R (Reduce, Reuse & Recycle) policy and all types of Resource Conservation Plan must be implemented.
9. Electricity production cannot commence without the Environmental Clearance.

Sd./Md. Zafar Alam
Director
Phone: 659379

Managing Director
United Ashuganj Energy Ltd.
United Center, House – NW(J) – 6, Road – 51,
Gulshan – 2, Dhaka - 1212

Annexure IV

Environmental Clearance

DoE, Brahamanbaria

Dated 2nd April, 2015

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

পরিবেশ অধিদপ্তর

ব্রাহ্মণবাড়িয়া জেলা অফিস, ব্রাহ্মণবাড়িয়া।

নম্বর- ২০৫

[বাংলাদেশ পরিবেশ সংরক্ষণ আইন ১৯৯৫ এর (১২) ধারা ও পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ এর বিধি (৭) অনুযায়ী ছাড়পত্র]

স্মারক নং- পরিবেশ/ব্রাঃজেঃঅঃ/ছাড়পত্র-৫৩৮/২০১৩/৭৬

তারিখঃ ১৯/১২/১৪২১ বাং
০২/০৪/২০১৫ খ্রী

পরিবেশগত ছাড়পত্র

পরিবেশ অধিদপ্তর, সদর দপ্তর, ঢাকার ১৭/০২/২০১৫ তারিখের পরিবেশ বিষয়ক কমিটির ৩৮৩ তম সভার কার্যবিবরণীর ক-০৪ নম্বর সিদ্ধান্ত মোতাবেক পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ অনুযায়ী "লাল" শ্রেণীভূক্ত বিবেচনায় আশুগঞ্জ পাওয়ার ষ্টেশন কমপ্লেক্স ব্রাহ্মণবাড়িয়া-এ অবস্থিত ইউনাইটেড আশুগঞ্জ এনার্জি লিমিটেড (আশগঞ্জ ২০০ মে.ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট) নামক ২০০ মে.ওয়াট বিদ্যুৎ উৎপাদন কেন্দ্র প্রকল্পটির অনুকূলে নিম্নবর্ণিত শর্তে পরিবেশগত ছাড়পত্র প্রদান করা হলো।

শর্তাবলী ঃ

১। বিদ্যুৎ উৎপাদন কেন্দ্রের কোন কর্মকান্ড ও প্রক্রিয়া দ্বারা কোনভাবে পরিবেশ (মাটি, পানি, বায়ু ও শব্দ) দূষণ করা যাবে না।

২। এ ছাড়পত্র ২০০ মেগাওয়াট বিদ্যুৎ উৎপাদনের জন্য প্রযোজ্য। প্রকল্পের উৎপাদন বৃদ্ধি, জায়গার সম্প্রসারণ, উৎপাদন প্রক্রিয়ায় বা তৎসংশ্লিষ্ট কোন প্রকার পরিবর্তনের জন্য পরিবেশ অধিদপ্তরের পূর্বানুমতি/ছাড়পত্রের প্রয়োজন হবে।

৩। বিদ্যুৎ কেন্দ্র হতে গ্যাসীয় পদার্থের নিঃসরণ (SOx, NOx, CO ইত্যাদি) এবং বস্তুকণার (Particulate Matters) নির্গমন পরিবেশ সংরক্ষণ বিধিমালা-১৯৯৭ এ উল্লেখিত মানমাত্রার মধ্যে হতে হবে। যে কোন সময় তাৎক্ষণিক সংগৃহীত নমুনায় এই মানমাত্রা অতিক্রম হতে পারবে না। কোন সময় দূষণ নিয়ন্ত্রণ ব্যবস্থা অকার্যকর হলে সাথে সাথে সংশ্লিষ্ট উৎপাদন ইউনিট বন্ধ করতে হবে। দূষণ নিয়ন্ত্রণ ব্যবস্থা সংস্কার করে বিধিবদ্ধ মানমাত্রা নিশ্চিতকরণ সাপেক্ষে বন্ধ ইউনিট পুনরায় চালু করা যাবে।

৪। কুলিং ওয়াটার পুনঃ ব্যবহারের জন্য স্থাপিত সকল ব্যবস্থাদি যথাযথভাবে কার্যক্ষম রাখতে হবে।

৫। প্রতিষ্ঠানের শব্দ এবং তরল/বায়বীয় বর্জ্যের নিঃসরণ/নির্গমন মাত্রা যথাক্রমে শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা, ২০০৬ এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ বর্ণিত মানমাত্রার মধ্যে হতে হবে।

৬। বায়বীয় বর্জ্য নির্গমনের জন্য স্থাপিত চিমনী সার্বক্ষণিক কার্যক্রম রাখতে হবে।

৭। Spent Lubricating Oil এবং Oil Filter পরিবেশ অধিদপ্তরের ছাড়পত্র গ্রহণকারী প্রতিষ্ঠান ব্যতিরেকে অন্য কোন Vendor এর কাছে বিক্রি করা যাবে না।

৮। বিদ্যুৎ কেন্দ্রে সৃষ্ট Residual Filtrate অথবা তৈল মিশ্রিত বর্জ্য কোন জলাশয়ে ফেলা যাবে না।

৯। বিদ্যুৎ কেন্দ্রের চত্তরে নূন্যতম ৩৩% জায়গা উপযুক্ত প্রজাতির ফলজ ও বনজ গাছ লাগিয়ে সবুজায়ন করতে হবে।

১০। Down Wind Direction এবং যেসব জায়গায় Ground Level Concentration সবচেয়ে বেশি বলে অনুমিত হয় সেসব জায়গায় পরিবেষ্টক বায়ুর গুণগত মান (SMP, SOx, NOx, CO) নিয়মিত মনিটর করতে হবে এবং মনিটরিং ফলাফল প্রতি তিন মাস অন্তর অন্তর পরিবেশ অধিদপ্তরে দাখিল করতে হবে।

১১। বিদ্যুৎ কেন্দ্রের পরিবেশগত ব্যবস্থাপনার জন্য প্রশিক্ষিত জনবল রাখতে হবে। কারখানা/প্রতিষ্ঠানের বর্জ্য ব্যবস্থাপনা সম্পর্কে দৈনিক ভিত্তিতে রেকর্ড সংরক্ষণ করতে হবে। প্রতি তিন মাস অন্তর অন্তর সংরক্ষিত রেকর্ডের সার-সংক্ষেপ রির্পোট আকারে পরিবেশ অধিদপ্তরে দাখিল করতে হবে।

১২। পেশাগত স্বাস্থ রক্ষার্থে সকল ব্যবস্থা সার্বক্ষণিক চালু রাখতে হবে। শ্রমিকদের নিয়মিত স্বাস্থ্য পরিক্ষা করতে হবে এবং এতদসংক্রান্ত রেকর্ড সংরক্ষণ করতে হবে।

১৩। অগ্নি দূর্ঘটনা নির্বাপনকল্পে প্লান্টে যথোপযুক্ত ব্যবস্থাদি যথা ফায়ার এক্সিট, ফোমিং কম্পাউন্ডসহ ফায়ার হাইড্রেন্ড, ইমারজেন্সি লাইট স্থাপন, ভূ-গর্ভস্থ বা ভূ-উপরিস্থ জলাধারে সর্বদা পর্যাপ্ত পানি সংরক্ষণ ইত্যাদি ব্যবস্থাদি সার্বক্ষনিক কার্যকরি রাখতে হবে।

১৪। কারখানার শব্দ এবং তরল/বায়বীয় বর্জ্যের নির্গমন/নির্গমন মাত্রা যথাক্রমে শব্দ দূষণ(নিয়ন্ত্রণ) বিধিমালা ২০০৬ এবং পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ এ বর্ণিত মানমাত্রার মধ্যে হতে হবে।

১৫। উপরোক্ত শর্তসমূহ যথাযথ ভাবে বাস্তবায়িত/প্রতিপালিত না হলে পরিবেশগত ছাড়পত্র বাতিল করা হতে পারে।

১৬। বাংলাদেশ পরিবেশ সংরক্ষণ আইন ১৯৯৫, পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ এ প্রদত্ত ক্ষমতা বলে উপরিল্লিখিত শর্তসমূহ এনফোর্স করা হবে।

১৭। এ ছাড়পত্র কোন অবস্থাতেই হস্তান্তর যোগ্য নয়।

১৮। পরিবেশগত ছাড়পত্রের মূলকপি বিদ্যুৎ কেন্দ্রে সংরক্ষণ করতে হবে। পরিবেশ অধিদপ্তরের পরিদর্শক ও পরিদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ কারখানা পরিদর্শনকালে ছাড়পত্র/নবায়নপত্র দেখতে চাইলে তা দেখাতে হবে এবং ছাড়পত্র/নবায়নপত্র কারখানার এমন স্থানে ঝুলিয়ে রাখতে হবে যা সহজে দেখা যায়।

১৯। এই ছাড়পত্র জারীর তারিখ হতে পরবর্তী ১(এক) বৎসরের জন্য বহাল থাকবে এবং মেয়াদ শেষ হওয়ার অন্তত ৩০(ত্রিশ) দিন পূর্বে উহা নবায়ন করতে হবে।

২০। উপর্যুক্ত ১-১৯ অনুচ্ছেদে বর্ণিত যে কোন শর্ত ভংগ করলে এ ছাড়পত্র বাতিল বলে গণ্য হবে এবং আপনার/আপনাদের বিদ্যুৎ কেন্দ্রের বিরুদ্ধে বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫; পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ এবং শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা, ২০০৬ অনুসারে আইনগত ব্যবস্থা গ্রহণ করা হবে।

০২/০৪/১৫

(মোঃ ছায়েফ উল্যা তালুকদার)
উপ-পরিচালক
ফোনঃ ০৮৫১/৫৭৭৫৭

মহাব্যবস্থাপক
ইউনাইটেড আশুগঞ্জ এনার্জি লিমিটেড
(আশগঞ্জ ২০০ মে.ওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্লান্ট)
আশুগঞ্জ পাওয়ার ষ্টেশন কমপ্লেক্স
উপজেলাঃ আশুগঞ্জ, জেলাঃ-ব্রাহ্মণবাড়িয়া।

স্মারক নং- পরিবেশ/ব্রাঃজেঃঅঃ/ছাড়পত্র-৫৩৮/২০১৩/

তারিখঃ /১২/১৪২১ বাং
/০৪/২০১৫ খ্রী

অনুলিপি ঃ সদয় অবগতির জন্য-

১। মহাপরিচালক, পরিবেশ অধিদপ্তর, সদর দপ্তর ঢাকা।

২। পরিচালক, পরিবেশ অধিদপ্তর, চট্রগ্রাম বিভাগীয় কার্যালয়, চট্রগ্রাম।

(মোঃ ছায়েফ উল্যা তালুকদার)
উপ-পরিচালক
ফোনঃ ০৮৫১/৫৭৭৫৭

Government of Bangladesh

Department of Environment

Brahmanbaria District Office, Brahmanbaria

Number - 205

[Environmental Clearance Certificate issued as per article 12 of Bangladesh Environment Conservation Act, 1995 and rule 7 of Environment Conservation Rules, 1997]

Memo No: Paribesh/ব্রাঃজেঃঅঃ/Clearance – 538/2013/73 Date: 02/04/2015

Environmental Clearance Certificate

As per resolution no. Ka – 04 of the minutes of the 383rd Meeting of the Environment Committee on 17/02/2015 at Department of Environment headquarter, the `electricity generating plant named United Ashuganj Energy Ltd. (Ashuganj 200 MW Combined Cycle Power Plant), situated inside Ashuganj Power Station Complex, Brahmanbaria, and being considered of Class "Red", as per Environment Conservation Rules, 1997, hereby issues the Environment Clearance Certificate under the following terms and conditions:

Terms & Conditions:

1. There cannot be any kind of environment (earth, water, air and sound) pollution through any activity of the electricity generating plant.
2. This clearance is only applicable for 200 MW electricity generation. In case of increase in generation, change in generation procedures/methodology or anything related will require permission or clearance from the Department of Environment.
3. Emission of gaseous substance (SOx, NOx, CO etc.) and Particulate Matters from the power plant must be within the limits ascribed in Electricity Conservation Rules, 1997. Samples collected at any instant cannot exceed this level at any instant. If at any time the pollution control system becomes ineffective then the respective generating unit must be shut down. The unit that has been shut down can be restarted upon repairing of the pollution control system and ensuring the emission levels with statutory limits.
4. All systems for re-using cooling water must be suitably/appropriately functional
5. The sound and liquid/air discharge/emission of the establishment must be within the limits ascribed in Sound Pollution (Control) Rules, 2006 and Electricity Conservation Rules, 1997, respectively.
6. The chimney installed for the discharge of gaseous waste must be operational at all times.
7. Spent Lubricating Oil and Oil Filter cannot be sold to any vendor excepting those having clearance from the Department of Environment.
8. Residual Filtrate or Waste mixed with oil produced from the power plant cannot be discharged to any water body.
9. At least 33% of the area of the project must be green zone consisting of trees of fruit and forestry of suitable species.
10. Surrounding air quality (SMP, SOx, NOx, CO) must be regularly monitored in locations having Down Wind Direction and in locations that are supposed to have the maximum Ground Level Concentration and the results of such monitoring must be submitted to the Department of Environment in every three months' interval.
11. Trained personnel must be employed for environmental management of the power plant. A daily record of the industry establishment's waste management must be maintained. A summary of the records maintained must be submitted to the Department of Environment in the form of a report in every three months interval.
12. All systems must remain operative at all times in order to protect professional health. Labors must undergo regular health check-up and all records in relation to this must be maintained.

13. Appropriate fire-fighting arrangements such as fire exit, fire hydrant having foaming compound, emergency light installation, adequate water storage under-ground or above ground at all times etc. must always be kept functional.
14. The sound and liquid/air discharge/emission level of the industry must be within the limits ascribed in Sound Pollution (Control) Rules, 2006 and Electricity Conservation Rules, 1997, respectively.
15. The Environmental Clearance may be revoked/cancelled if the above-mentioned terms and conditions are not implemented/observed.
16. The above-mentioned terms and conditions shall be enforced by the power vested by Bangladesh Environment Conservation Act 1995, Environment Conservation Rules 1997.
17. This Clearance is not transferrable under any circumstances
18. The original copy of the Environmental Clearance Certificate shall be preserved in the power plant. If any inspector of Department of Environment or any other official vested with the responsibility of inspection there from during their inspection want to see the Clearance Certificate/Renewal Certificate then those must be shown and the Clearance Certificate/Renewal Certificate must be hung in a place from where it is easily visible.
19. This Clearance Certificate shall remain valid for 1 (one) year from the date it is issued and shall need to be renewed at least 30 (thirty) days prior to its date of expiry
20. If any of the terms and conditions described in above clause 1-19 is breached then this clearance will be considered null and void and action will be taken against your power plant as per Bangladesh Environment Conservation Act, 1995; Environment Conservation Rules 1997 and Sound Pollution (Control) Rules, 2006.

Sd/ Md. Sayef Ullah Talukdar
Deputy Director
Phone: 0851/57757

Managing Director
United Ashuganj Energy Ltd.
(Ashuganj 200 MW Combined Cycle Power Plant)
Ashuganj Power Station Complex
Upazilla: Ashuganj, District: Brahmanbaria

Annexure V

License from BERC

Dated 26th April, 2015

Certificate No. IPP-026

Government of the People's Republic of Bangladesh

Bangladesh Energy Regulatory Commission

DHAKA. BANGLADESH

in conformity with the sections 27 & 28 of the 'Bangladesh Energy Regulatory Commission Act, 2003', and regulation 15(9) & 15(10) of the 'Bangladesh Energy Regulatory Commission License Regulations, 2006', hereby issues this Provisional License for generation of 210.70 (Two hundred ten point seven zero) MW electricity based on Natural Gas as Independent Power Producer (IPP) at Ashuganj, B. Baria in favour of

United Ashuganj Energy Limited

United Centre, House No. NW (J)-6, Road No. 51, Gulshan-2, Dhaka-1212

under the terms and conditions incorporated in the License Number : BERC/POWER/IPP-026/L/035(Part-1)/ ..1474..... dated 26 April, 2015.

This Certificate will remain valid from 26 April, 2015 to 25 April, 2016.

26-04-15

Md. Habibur Rahman
Secretary

Annexure VI

Specifications of the Wärtsilä Engines

A. Technical specifications

Number of engines	20
Plant output	194.60 MW

Generating set

Engine	
Engine type	W20V34SG
Number of cylinders	20
Cylinder bore	340 mm
Stroke	400 mm
Speed	750 rpm
Rated output	10,000 kW
Main voltage	400 V; 50 Hz
Secondary voltage	24 VDC
Rotation direction	Clockwise

Generator	
Generator type	AMG 1120LT08 DSE
Output	12,163 kVA
Power factor	0.80
Voltage	11 kV
Current	638 A
Frequency	50 Hz
Anticondensation heater power	1.6 kW

Other equipment	
Flexible coupling	RENOLD DCB GS658.5 SM50
Vibration damper	GEISLINGER D90/45
Turbocharger	Napier NA357

Power distribution system

Medium voltage system	
Voltage	11 kV

Low voltage system	
Voltage	400 V

Lubricating oil circulation system

Prelubrication pump	
Motor power	15 kW

Oil mist separator	
Motor power	1.5 kW

Compressed air system

Starting air unit	
Starting pressure	25 bar
Stopping pressure	30 bar
Compressor capacity	230 m^3/h
Motor power	45 kW

Instrument air unit	
Operating pressure	7 bar
Capacity	174 m^3/h
Power, compressor motor	22 kW

Starting air vessel	
Volume	4800 l

Cooling water system

Radiators	
Number of radiators per engine	3
Number of cooling fans per radiator	4
Motor power	7.5 kW

Expansion vessel	
Volume	600 l

Preheating unit	
Motor power	0.65 kW
Heater power	54 kW

Charge air system

Charge air filter	
Motor power, oil bath filter	0.18 kW
Number of fine filters	16

Exhaust gas system

Exhaust gas silencer	
Attenuation	35 dB(A)

Exhaust gas ventilation unit	
Motor power, ventilation fan	4 kW

A2.5 COOLING SYSTEM

The main task of the cooling system is to provide adequate cooling of critical engine components such as cylinder jackets, cylinder heads and turbochargers as well as to cool the lubrication oil and charge air entering the cylinders after it has been compressed by the turbocharger.

The engine cooling water cools the low temperature charge air cooler, lubricating oil cooler, high temperature charge air cooler and engine jackets, and the HT circuit is cooled in a 1-circuit radiator.

The cooling system consists of the following main equipment:

19 Cooling radiator

The engines are cooled with remote mounted, horizontal type radiators with electrically driven induced draft fans. Each engine generator set has its own cooling radiator package comprising:

1	Radiator cooler circuit		
	Frame material		Hot dipped galvanized steel
	Tube material		Copper
	Fin material		Aluminium
	Noise level	61	dB(A) at 40 m distance

19 Cooling radiator ladder and railings

Radiators are supplied with railings and inspection ladder.

A2.6 CHARGE AIR SYSTEM

The charge air filter protects the engine against impurities in the inlet air and the charge air silencer reduces the air intake noise from the engine

19 Charge air filter

The air inlet to the filter is equipped with a vertical weather louver for removal of water droplets. The combined oil wetted and dry filter type filter have 2-stage filtration. The oil wetted contains filter panels that move vertically inside the filter housing. After a complete revolution the filter elements are soaked in oil where the dust particles settle in the oil basin. The next dry filter stage consists of several replaceable filter panels with pleated filter media for increased filtration efficiency. The filter elements are accessed through a maintenance opening.

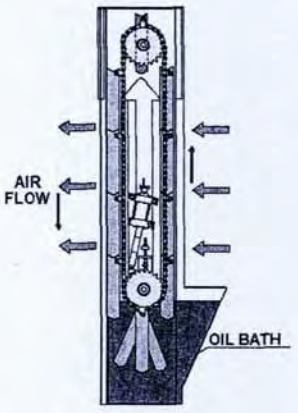
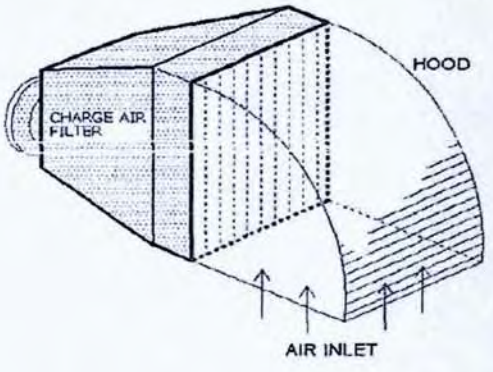


Figure 11 Picture of an oil wetted filter

19 Weather hood

The weather hood is protecting the charge air filter from excessive amounts of water or snow. In case the hood should protect expressly against rain, it is always to be assembled in combination with a droplet separator louver.



A2.7 EXHAUST SYSTEM

The exhaust gas of the engine is discharged at the required height through the exhaust gas silencer and stack pipe. The exhaust gas silencer reduces the exhaust noise from the engine

19 Exhaust gas silencer

The exhaust gas silencer reduces the noise emission from the engine exhaust outlet.

Noise attenuation	35 dB(A)

CONFIDENTIAL Emission data sheet

Title:	Ashuganj 20V34SG emissions	**Doc.ID:**	DBAB811081
		Revision:	b
Author:	Sofia Laxström	**Status:**	Finalised
Finalised by:	Riitta Raudaskoski / 27.09.2013	**Pages:**	1 (2)
Organisation:	- General Power Plants		
Project :	IN026 – WNS-P DOCVISION		

Ashuganj 20V34SG emissions.docx

This document provides estimated exhaust gas emission data which is valid for the site conditions, gas composition and measurement methods specified in this document.

Engine: Wärtsilä® 20V34SGC2 at 750 RPM (constant speed), CR 11

- max. total pressure drop in air intake and flue gas system 7 kPa

Site design conditions:

- Intake air or ambient temperature 35 ℃
- Relative humidity 60 %
- Altitude above sea level 100 m
- LT charge air coolant temperature (max.)* 54 ℃

* *At above given conditions*

Gas analysis:

Methane number:			80
Methane	CH_4	94.95	vol-%
Ethane, max	C_2H_6	3.02	vol-%
Propane, max	C_3H_8	0.96	vol-%
i-Butane, max	C_4H_{10}	0.32	vol-%
n-Butane, max	C_4H_{10}	0.23	vol-%
i-Pentane, max	C_5H_{12}	0.11	vol-%
n-Pentane, max	C_5H_{12}	0.06	vol-%
Hexane, max	C_6H_{14}	0.04	vol-%
Heptane and higher hydro carbons		0.00	vol-%
Nitrogen	N_2	0.25	vol-%
Carbon dioxide	CO_2	0.06	vol-%
Total sulphur, max S		5	mg/kg

No silicon and aromatic based compounds

Other gas parameters according to Wärtsilä's specification.

Lubrication oil: According to Wärtsilä's specification

Flue gas emission data at normal full (100% load) steady load at site conditions after engine:

- NO_x emissions (calc. as NO_2) max. 200 mg/Nm^3 (dry, at 15 vol-% O_2)

Nm^3 defined at 0 ℃ and 101.3 kPa (abs.)

Emissions given here are valid only with the measurement methods specified on page 2 of this document.

Flue gas emission measurement methods:

Nitrogen oxides (NO_X): EPA Method 7E (USA): Determination of nitrogen oxides from stationary sources (instrumental analyzer method). Or principally similar other methods.

Oxygen (O_2): EPA Method 3A (USA): Determination of oxygen and carbon dioxide emissions from stationary sources (instrumental analyzer method). Or principally similar other methods.

Measurement uncertainties and acceptance: The measurement tolerances (uncertainties) will be as specified by the measurement consultant. Assessment of the fulfilment of the guarantees shall be made according to Section 6.2 of the VDI 2048 guidelines "Uncertainties of measurement during acceptance tests on energy-conversion and power plants".

Measurement principles: Before emission testing the engines to be tested shall be operated minimum two (2) hours at stable full load. Based on the judgement of the measurement consultant, the results of the individual samples with abnormally high deviation shall be excluded. The plant average result of all the tested engines is calculated from the engine-specific average results. The plant average result, after corrected with the measurement tolerances as specified above, shall be used to verify the fulfilment of the guarantee.
In case the plant average result is not in compliance with the guarantee value, the engine(s) causing the non-compliance with high engine-specific average results as per the evaluation and decision by Wärtsilä, shall be checked and adjusted. The flue gas emissions of those re-adjusted engine(s) shall be re-tested according to the same guidelines as used in the original emission tests.

Annexure VII

Land Lease Between

Bangladesh Railways Authority and APSCL

Summary of lease agreement between Bangladesh Railway & APSCL

Bangladesh Railway and APSCL entered in to an agreement on 19 September 2013 for perpetual lease of 16.43 acres under certain terms and conditions. Some of the conditions are mentioned below:

(a) Down payment of 15% of lease rent before signing of the agreement between APSCL and BR
(b) Remaining lease amount to be paid through ten equal installments by APSCL to BR
(c) APSCL shall be given permission to construct the power plant after down payment
(d) APSCL sign agreement for plant construction and can handover the land through an agreement to the project company for the purpose of foreign debt financing
(e) Any existing fishing licenses must be cancelled and the affected licensees shall be compensated by APSCL
(f) The land shall be registered to APSCL after complete payment of lease rent to BR, after ten years

The 3rd page of the lease agreement between APSCL and Bangladesh Railway states the deposit being made at EXIM Bank against a pay order as compensation (Pay Order No. 0969825/6969 dated 27-08-2013, EXIM Bank, Agrabad Branch, Chittagong, Bangladesh)

কক ২০৮৩৬৮৩

দেশের বিদ্যুৎ ঘাটতি মোকাবেলায় আশুগঞ্জ পাওয়ার স্টেশন এলাকায় পাওয়ার প্লান্ট স্থাপনের নিমিত্তে বাংলাদেশ রেলওয়ের জমি আশুগঞ্জ পাওয়ার স্টেশন কোম্পানী লিঃ (এপিএসসিএল) এর অনুকূলে বরাদ্দ প্রদান সম্পর্কিত চুক্তিনামা।

অত্র চুক্তিপত্র ২০১৩ সালের সেপ্টেম্বর মাসের ১৯ তারিখে/১৪২০ বাংলা সনের আশ্বিন মাসের ০৪ তারিখে নিম্নবর্ণিত পক্ষগণের মধ্যে সম্পাদিত হল।

গণপ্রজাতন্ত্রী বাংলাদেশ সরকারের মহামান্য রাষ্ট্রপতির পক্ষে প্রধান ভূ-সম্পত্তি কর্মকর্তা(পূর্বাঞ্চল) বাংলাদেশ রেলওয়ে, চট্টগ্রাম (যাকে এই চুক্তিনামার ১ম পক্ষ হিসেবে গণ্য করা হবে)--- **১ম পক্ষ (প্রথম পক্ষ)।**

এবং

নির্বাহী পরিচালক (অর্থ) ও কোম্পানী সচিব, আশুগঞ্জ পাওয়ার স্টেশন কোম্পানী লিঃ (এপিএসসিএল), **আশুগঞ্জ, ব্রাহ্মণবাড়িয়া-৩৪০২(যাকে এই চুক্তিনামার ২য় পক্ষ হিসেবে গণ্য করা হবে)--- ২য় পক্ষ (দ্বিতীয় পক্ষ)।**

যেহেতু মহাপরিচালক, বাংলাদেশ রেলওয়ে, রেলভবন, ঢাকা দপ্তরের ০২-০৪-২০১৩ ও ১৮-০৭-২০১৩ তারিখের রেবি/ভূস/২৬/২০০১(অংশ-৬)-২৪৬ ও ৫২৪ এবং রেলপথ মন্ত্রণালয়ের ২৮-০৩-২০১৩ ও ১৬-০৭-২০১৩ তারিখের ৫৪.০০.০০০০.০০৯.৩১.০৮৫.২০১০-১১৮ ও ২৫৬ সংখ্যক পত্রের মাধ্যমে সরকার আশুগঞ্জ পাওয়ার স্টেশন কোম্পানী লিঃ (এপিএসসিএল) এর প্রকল্পের জন্য বাংলাদেশ রেলওয়ের ব্রাহ্মণবাড়িয়া জেলাধীন আশুগঞ্জ মালগুদাম সাইডিং লাইন এলাকায় সোনারামপুর মৌজার জেএল নং-১৭৮, সিএস দাগ নং-৬৬৪ ও ২২০ এর অংশে প্রস্তাবিত ভূমি ৫টি প্লটে যথাক্রমে এ-প্লট ৫৫০´ X ২১´ = ১১৬০৫০ বর্গফুট বা ২.৬৭ একর, বি-প্লট ৩৪০´ X ২১´ = ৭১৭৪০ বর্গফুট বা ১.৬৫ একর, সি-প্লট ৩৫´ X ২৫০´ = ৮৮৭৫০ বর্গফুট বা ২.০৩ একর, ডি-প্লট ৭০০´ X ২২০´ = ১৫৪০০০ বর্গফুট বা ৩.৫৪ একর, ই-প্লট ১১৪০´ X ২৫০´ = ২৮৫০০০ বর্গফুট বা ৬.৫৪ একর সর্বমোট ১৬.৪৩ (ষোল দশমিক চার তিন) একর রেলভূমি রেলওয়ের ভূ-সম্পত্তি ব্যবস্থাপনা নীতিমালা, ২০০৬ এর অনুচ্ছেদ-৬.৩ এবং অনুচ্ছেদ-৯ মোতাবেক ইঞ্জিনিয়ারিং কোডের ৮১৩-এ ধারা শিথিলক্রমে সরকার নিম্নোক্ত শর্তানুযায়ী আশুগঞ্জ পাওয়ার স্টেশন কোং লিঃ(এপিএসসিএল) এর অনুকূলে স্থায়ী লীজ (Perpetual Lease) প্রদানের সিদ্ধান্ত প্রদান করা হয়েছে.

শর্তাবলী ঃ

(১) আশুগঞ্জ পাওয়ার স্টেশন কোং লিঃ (এপিএসসিএল) এর অনুকূলে বরাদ্দকৃত ১৬.৪৩ একর ভূমির মূল্য বাবদ ধার্যকৃত ১১১,৬০,৮২,০৪৭/- (একশ এগার কোটি ষাট লক্ষ বিরাশি হাজার সাতচল্লিশ) টাকার ১৫% Down Payment হিসেবে ১৬,৭৫,০০,০০০/-(ষোল কোটি পঁচাত্তর লক্ষ) টাকা এককালীন পরিশোধ করতে হবে;

(২) এপিএসসিএল কে অবশিষ্ট ৯৪,৮৫,৮২,০৪৭/- টাকা সমান দশ কিস্তিতে অর্থাৎ প্রতি কিস্তিতে ৯,৪৮,৫৮,২০৫/- টাকা হিসেবে পরবর্তী প্রতি বৎসর ৩০শে জুনের মধ্যে পরিশোধ করতে হবে;

(৩) Down Payment এর পর বাংলাদেশ রেলওয়ের লীজকৃত ভূমিতে এপিএসসিএল পাওয়ার প্ল্যান্ট নির্মাণের কাজ শুরু করার অনুমতি দেয়া হবে;

চলমান পাতা-২

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(৪) এপিএসসিএলকে কিস্তির বার্ষিক Instalment যথাসময়ে অর্থাৎ ৩০শে জুনের মধ্যে পরিশোধ করতে হবে;

(৫) এপিএসসিএল এর অনুকুলে লীজকৃত ভূমির উপর প্রস্তাবিত ২০০ মেগাওয়াট মডিউলার পাওয়ার প্ল্যান্ট স্থাপনের নিমিত্ত অর্থাৎ প্রকল্প বাস্তবায়নে বিদেশী ঋণ পাওয়ার স্বার্থে প্রয়োজনে প্রকল্প বাস্তবায়নকারী কোম্পানীর নিকট ভূমির দখল হস্তান্তরসহ বিদ্যুৎ কেন্দ্র স্থাপনের বিষয়ে এপিএসসিএল চুক্তি সম্পাদন করতে পারবে;

(৬) কবল কিস্তির টাকা পরিশোধের পর বরাদ্দকৃত ভূমি আশুগঞ্জ পাওয়ার স্টেশন কোং লিঃ (এপিএসসিএল) এর অনুকুলে বিধি মোতাবেক রেজিস্ট্রি করে দেয়া হবে;

(৭) এপিএসসিএল এর কিস্তির টাকা বার্ষিক কিস্তিসহ ১০(দশ) বৎসরের মধ্যে সমুদয় টাকা পরিশোধে ব্যর্থ হলে Down Payment এর টাকাসহ যাবতীয় পরিশোধিত টাকা বাজেয়াপ্তসহ লীজকৃত ভূমির উপর প্রতিষ্ঠিত যাবতীয় স্থাপনা, মেশিনারী ইত্যাদি বাজেয়াপ্ত হবে এবং বাংলাদেশ রেলওয়ের অনুকুলে ন্যস্ত হবে;

(৮) ভবিষ্যতে উল্লেখিত বিদ্যুৎ উৎপাদন প্রকল্পটি কোন কারণে সফল না হলে কিংবা এর কার্যক্রম বন্ধ হলে বা পরিত্যক্ত হলে এ বরাদ্দ বাতিল বলে গণ্য হবে এবং সমুদয় জমি ও স্থাপনা বাংলাদেশ রেলওয়ের অনুকুলে ন্যস্ত হবে;

(৯) প্রস্তাবিত পুকুরের পূর্বের মৎস্য লাইসেন্স বাতিল করতে হবে বিধায় ক্ষতিগ্রস্থ লাইসেন্সীদের ক্ষতিপূরণ প্রদানের ব্যয়ভার প্রত্যাশি সংস্থাকে বহন করতে হবে;

(১০) প্রস্তাবিত ভূমি পাওয়ার প্ল্যান্ট ছাড়া অন্য কোন উদ্দেশ্যে ব্যবহার করা যাবেনা;

(১১) কোন দায়/পাওনা আদায়যোগ্য হলে প্রথম পক্ষ ১৯১৩ সালে পিডিআর এ্যাক্ট এবং অন্যান্য প্রচলিত আইনের বিধান প্রয়োগ করে যাবতীয় পাওনা/দায় এর টাকা ২য় পক্ষের নিকট হতে আদায় করতে পারবে;

(১২) বরাদ্দকৃত ভূমি ও তদস্থিত স্থাপনা বাংলাদেশ রেলওয়ের সংশ্লিষ্ট যে কোন কর্মকর্তা যে কোন সময়ে বিনা নোটিশে পরিদর্শন করতে পারবেন;

(১৩) চুক্তির যে কোন শর্ত বা শর্তাবলী ভঙ্গ করলে ১ম পক্ষ ২য় পক্ষকে উচ্ছেদ করত: ভূমির পুনর্দখল গ্রহণ করতে পারবেন এবং পিডিআর এ্যাক্ট বা অন্য প্রচলিত আইনে সরকারী পাওনা ও যাবতীয় খরচসহ আদায় করতে পারবে। এর জন্য ২য় পক্ষ কোনরূপ ক্ষতিপূরণ দাবী করতে পারবেনা;

(১৪) ১ম পক্ষ তথা রেলওয়ে কর্তৃপক্ষের সিদ্ধান্তের বিরুদ্ধে ২য় পক্ষ কোন আদালতের আশ্রয় নিতে পারবেনা। নিলে তা সর্ব আদালতে অগ্রাহ্য বা বাতিল বলে গণ্য হবে; এবং

(১৫) বাংলাদেশ রেলওয়ের (১ম পক্ষের) স্বার্থের অনুকূলে হবে এরূপ ক্ষেত্রে চুক্তিপত্রের যে কোন শর্ত শিথিল করার এবং/বা উভয় পক্ষের সম্মতিক্রমে চুক্তিপত্রে শর্ত সংযোজন করার এখতিয়ার মহাব্যবস্থাপক/পূর্ব, বাংলাদেশ রেলওয়ে সংরক্ষণ করবে। চুক্তিপত্রে উল্লেখিত শর্ত বা উল্লেখ করা হয়নি এমন শর্তাদির বিষয়ে কোন dispute দেখা দিলে আলোচনাক্রমে মহাব্যবস্থাপক(পূর্ব) নিষ্পত্তি করবেন। এক্ষেত্রে মহাব্যবস্থাপক(পূর্ব) এর সিদ্ধান্ত চূড়ান্ত বলে গণ্য হবে।

চলমান পাতা-৩

কক ২০৮৩৬৭৬

ভূমির তফশীল

স্টেশনের নাম	জমির পরিমাণ	বরাদ্দকৃত ভূমির ধার্যকৃত বাজারমূল্য	মন্তব্য
(১)	(২)	(৩)	(৪)
ব্রাহ্মণবাড়িয়া	১৬.৪৩ একর	১১১,৬০,৮২,০৪৭/-	১৬.৪৩ একর রেলভূমির বাজারমূল্য বাবদ ধার্যকৃত ১১১,৬০,৮২,০৪৭/- টাকার ১৫% Down Payment ১৬,৭৫.০০,০০০/- টাকা পে-অর্ডার নং-০৯৬৯৮২৪/৬৯৬৮ তারিখ: ২৭-০৮-২০১৩ এক্সিম ব্যাংক লিঃ, আগ্রাবাদ শাখা, চট্টগ্রাম এবং ক্ষতিপূরণ বাবদ ৩,৬২,৯৬৭/- টাকা পে-অর্ডার নং-০৯৬৯৮২৫/৬৯৬৯ তারিখ: ২৭-০৮-২০১৩ এক্সিম ব্যাংক লিঃ, আগ্রাবাদ শাখা, চট্টগ্রাম এর মাধ্যমে পরিশোধ আছে।

২য় পক্ষের স্বাক্ষর

নাম-

নির্বাহী পরিচালক (অর্থ)

ঠিকানা----

সাক্ষীগণের স্বাক্ষর

১।

২।

৩।

Engr. Ajit Kumar Barker
Project Director
200MW Modular Power Plant Project
Ashuganj Power Station Co. Ltd.

১ম পক্ষের স্বাক্ষর

প্রধান ভূ-সম্পত্তি কর্মকর্তা(পূর্ব)

গণপ্রজাতন্ত্রী বাংলাদেশ সরকারের

সাক্ষীগণের স্বাক্ষর

১।

২।

৩।

Annexure VIII

Land Lease Between

APSCL and UAEL

LAND LEASE AGREEMENT

BY AND BETWEEN

THE ASHUGANJ POWER STATION COMPANY LTD.

(An enterprise of Bangladesh Power Development Board)

AND

UNITED ASHUGANJ ENERGY LTD.

- RELATING TO-

ASHUGANJ 200 MW GAS FIRED MODULAR POWER PLANT

AT

ASHUGANJ, BRAHMANBARIA, BANGLADESH

DATED AS OF 27th OCTOBER, 2013

TABLE OF CONTENTS

THIS LAND LEASE AGREEMENT (this "**Lease Agreement**") is entered into as of this ____ day of ___ _____ 2013 in Dhaka, Bangladesh

BY AND BETWEEN

ASHUGANJ POWER STATION COMPANY LIMITED, with its registered office located at Ashuganj, B'Baria,, Bangladesh, and hereinafter referred to as the **"APSCL"**, which expression includes its successors, representatives or assigns;

AND

United Ashuganj Energy Ltd. with its corporate office located at United Centre, House # NW J(6), Road 51, Gulshan 2, Dhaka, Bangladesh, and hereinafter referred to as the "Company", which expression includes its successors, representatives and permitted assigns (APSCL and the Company are sometimes hereinafter referred to individually as a **"Party"** and, collectively, as the "**Parties**"),

RECITALS

WHEREAS, the Company has agreed to design, engineer, manufacture, finance, construct, complete, permit, test, commission, insure, own, operate and maintain a Gas (as hereinafter defined) fired power station (the **"Facility"**, as hereinafter defined) located at Ashuganj, Bangladesh, to provide 195 MW (net) of electric power generation capacity to BPDB under a Power Purchase Agreement (as defined hereinafter).

WHEREAS, APSCL has acquired a parcel of land comprising 16.430 acres near the Ashuganj Power plant, which is located approximately 100 kilometers from Dhaka, and has also acquired all necessary rights-of-way and access to and from such parcel to public highways at Ashuganj, a portion of which parcel measuring 6.48 Acres is available for the location, construction, operation and maintenance of the Facility.

WHEREAS, APSCL is in exclusive possession of an approximately 6.48 acre parcel of the land described in Schedule 1 (the "Demised Property", as hereinafter defined), and has agreed to lease the Demised Property, which is approximately 6.48 acres described in Schedule 1, to the Company for the Site (as hereinafter defined) to be used for the construction, operation and maintenance of the Facility for the term of this Agreement.

NOW, THEREFORE, in consideration of the mutual benefits and covenants contained herein, APSCL and the Company hereby agree as follows:

SECTION 1: DEFINITIONS AND INTERPRETATION

1.1 Definitions

Whenever the following capitalized terms appear in this Lease Agreement, including the schedules hereto, whether in the singular or plural, past, present or the future tense, such terms shall have the meanings given below:

"**Access Road**" means the existing access road from the (N2) highway to the Site, as shown on Annexure II to Schedule I;

"**Agent**" bears the meaning ascribed thereto in Section 7.4(b) (i);

"**Bank Rate**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**APSCL Event of Default**" bears the meaning ascribed thereto in Section 7.2(a);

"**APSCL Notice of Default**" bears the meaning ascribed thereto in Section 7.1(a);

"**Business Day**" means any Day that is not (a) a Day on which banks in Bangladesh are legally permitted to be closed for business (including partial Days), and (b) an official holiday declared by the GOB;

"**Centre**" bears the meaning ascribed thereto in Section 9.4(a);

"**Commercial Operations Date**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Company**" means United Ashuganj Energy Ltd a public limited company incorporated and registered under the laws of Bangladesh with its principal offices located in Dhaka , Bangladesh and its successors and permitted assigns.

"**Company Communication Facilities**" bears the meaning ascribed thereto in the Gas Supply Agreement;

"**Company Event of Default**" bears the meaning ascribed thereto in Section 7.1(a);

"**Company Notice of Default**' bears the meaning ascribed thereto in Section 7.2(a);

"**Company Transportation Facilities**" bears the meaning ascribed thereto in the Gas Supply Agreement;

"**Contract Year**" means (a) in respect of the first Contract Year, the period commencing at the beginning of the Possession Date and ending as of the end of the Day immediately preceding the first anniversary of the Possession Date, and (b) thereafter, the period commencing at the beginning of each consecutive anniversary of the Possession Date and ending as of the end of the last Day preceding the next anniversary of the Possession Date;

"**Contractors**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Convention**" bears the meaning ascribed thereto in Section 9.4(a);

"**Day**" means the twenty-four (24) hour period beginning and ending at 12:00 midnight Bangladesh Standard time;

"**Demised Premises**" means the parcel of land described as such in Part A of Schedule I and shown in Annexure I to Schedule I;

"**Dispute**" means any dispute, difference or disagreement of any kind whatsoever between APSCL and the Company in connection with or arising out of this Lease Agreement, including, without limitation, any dispute or difference concerning the existence, validity or enforceability of this Lease Agreement or any provision hereof;

"**Dollars**" and "**US$**" means the lawful currency of the United States of America;

"**Election Notice**" bears the meaning ascribed thereto in Section 7 4(d)(ii);

"**Electrical Interconnection Facilities**" bears the meaning ascribed thereto in the PPA;

"**Environmental Guidelines**" means the environmental guidelines and occupational health and safety standards of the World Bank Group as in effect on 10 June 2012;

"**Environmental Liabilities**" means all losses, damages, and expenses (including, without limitation, the reasonable costs of investigation, testing, containment, removal, cleanup, abatement or remediation and reasonable attorneys' fees and costs), whether or not quantified in amount, relating to the presence in the environment of Hazardous Materials attributable to the Facility or the Site from the Possession Date to the end of the Term (or, if earlier, the first to occur of the surrender of the Demised Premises by the Company to APSCL, the termination of this Lease Agreement, the assignment of this Lease Agreement to the GOB, or the date of transfer of the Facility to the GOB or its designee), or the violation by the Company, its agents or employees of any environmental Laws of Bangladesh or the Environmental Guidelines;

"**Environmental Matters**" means any of the following:

(a) any release, emission, entry or introduction into the air, including the air within buildings and other natural or man-made structures above ground of any Hazardous Material or any material or substance regulated under the Environmental Guidelines,

(b) any discharge, release or entry into water, including into any river, watercourse, lake or pond (whether natural or artificial or above ground or which joins or flows into any such water outlet above ground) or reservoir, or the surface of the river bed or of other land supporting such waters, ground waters, sewer or the sea of any Hazardous Material or any material or substance regulated under the Environmental Guidelines,

(c) any deposit, disposal, keeping, treatment, importation, exportation, production, transportation, handling, processing, carrying, manufacture, collection, sorting or presence of any Hazardous Material or any material or substance regulated under the Environmental Guidelines (including, in the case of waste, any substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of any process or activity (including making it reusable or reclaiming substances from it) and any substance or article which is required to be disposed of as being broken, worn out, contaminated or otherwise spoiled),

(d) the conservation, preservation or protection of the natural or man-made environment or any living organisms supported by the natural or man-made environment, or

(e) any other matter whatsoever directly affecting the environment or any part of it;

"**Evaluation Period**" bears the meaning ascribed thereto in Section 7.4(d)(i);

"**Event of Default**" means a Company Event of Default or a APSCL Event of Default, as the case may be;

"**Expert**" means an expert appointed pursuant to Section 9;

"**Extended Access Road**" means the interest in land described as such in Part B of Schedule I, the location of which is shown in Annexure II to Schedule I;

"**Facility**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Financial Closing**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Financial Closing Date**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Financing Documents**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Force Majeure Event**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Foreign Investors**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Gas**" bears the meaning ascribed thereto in the Gas Supply Agreement;

"**Gas Supplier**" bears the meaning ascribed thereto in the Gas Supply Agreement;

"**Gas Supply Agreement**" means the agreement between the Gas Supplier and the Company for the supply of Gas to be used as fuel by the Company at the Facility to generate electric power, as may be amended by the parties thereto from time to time with the prior written approval of BPDB;

"**GOB**" means the Government of the People's Republic of Bangladesh;

"**Government Authority**" bears the meaning ascribed thereto in the Power Purchase Agreement;

"**Guarantee**" means the guarantee by the GOB of the payment obligations of:

(a) BPDB under the Power Purchase Agreement,

(b) the Gas Supplier under the Gas Supply Agreement;

(c) APSCL under this Lease Agreement; and

(d) APSCL under the Share Purchase Agreement;

substantially in the form set out in Schedule 3 of the Implementation Agreement, as may be amended from time to time by agreement of the GOB and the Company;

"**Hazardous Materials**" means any pollutant, contaminant, solid waste, hydrocarbon product, toxic or hazardous substance or waste, any flammable, explosive or radioactive materials regulated under, or subject to, any Laws of Bangladesh;

"**ICC Rules**" bears the meaning ascribed thereto in Section 9.4(b);

"**ICSID Rules**" bears the meaning ascribed thereto in Section 9.4(a);

"**Implementation Agreement**" means the Implementation Agreement executed between the GOB and the Company in connection with the Project, and also includes any amendment of it made by the parties thereto from time to time;

"**Incremental Costs**" bears the meaning ascribed thereto in Section 9.4(c);

"**Initial Cure Period**" bears the meaning ascribed thereto in Section 7.4(a);

"**Initial Shareholders**" bears the meaning ascribed thereto in the Implementation Agreement;

"**Laws of Bangladesh**" means, in relation to this Lease Agreement, all laws in force in Bangladesh, and includes all rules, regulations, orders, directives, notifications made or issued by any Government

Authority with authority over the Company, the Facility or the Project pursuant to or under any such law, and any decree or judicial decision given or pronounced by any court of competent jurisdiction in Bangladesh;

"**Lease Agreement**" means this Land Lease Agreement between APSCL and the Company, together with all schedules attached hereto, dated as of the date first above written, and includes any amendment of it made by the Parties from time to time;

"**Lenders**" bears the meaning ascribed thereto in the Implementation Agreement;

"**Lenders Cure Period**" bears the meaning ascribed thereto in Section 7.4(e)(i);

"**Lien**" bears the meaning ascribed thereto in the Implementation Agreement;

"**Loss**" bears the meaning ascribed thereto in the Implementation Agreement;

"**Notice of Intent to Terminate**" bears the meaning ascribed thereto in Section 7.3(a)(i);

"**Ordinary Share Capital**" bears the meaning ascribed thereto in the Implementation Agreement;

"**Parties**" means both APSCL and the Company;

"**Party**" means either APSCL or the Company;

"**Permitted Liens**" means minor imperfections of title and encumbrances that in the aggregate are not substantial in amount, do not detract from the value of the property subject thereto or impair the ownership, possession, use or operation of the Facility, and existed at the date of acquisition or have arisen only in the ordinary course of business and consistent with normal utility practices;;

"**PGCB**" means the Power Grid Company of Bangladesh, Ltd, and its successors and assigns;

"**Possession Date**" bears the meaning ascribed thereto in Section 2.3;

"**Power Purchase Agreement**" means the Power Purchase Agreement executed between BPDB and the Company for the sale of Dependable Capacity and Net Energy Output (as each term is defined therein) by the Company to BPDB from the Facility, as such agreement may be amended by the parties thereto from time to time;

"**Project**" means the development, design, engineering, manufacturing, financing, construction, permitting, start-up, testing, completion, insurance, commissioning, ownership, operation and maintenance of the Facility, and all activities incidental thereto;

"**Project Agreements**" means, collectively, this Lease Agreement, the Implementation Agreement, the Gas Supply Agreement, the Share Purchase Agreement and the Power Purchase Agreement;

"**Project Effective Date**" means the date on which the last of the Project Agreements is executed and delivered by each of the parties thereto and none of the agreements so executed have terminated or been terminated by a party thereto;

"**Protected Assets**" bears the meaning ascribed thereto in Section 9.5(a)(i);

"Required Financial Closing Date" bears the meaning ascribed thereto in the Implementation Agreement;

"Rent" bears the meaning ascribed thereto in Schedule II;

"Road Specifications" means the design and construction criteria, specifications and requirements for the Extended Access Road as specified in Schedule 3.

"Scheduled Possession Date" bears the meaning ascribed thereto in Section 2.2;

"Security Package" bears the meaning ascribed thereto in the Implementation Agreement;

"Share Purchase Agreement" bears the meaning ascribed thereto in the Implementation Agreement;

"Site" means the land described as such in Schedule I;

"Succession Notice" bears the meaning ascribed thereto in Section 6.2(b);

"Taka" or **"Tk."** means the lawful currency of Bangladesh;

"Take-Over" bears the meaning ascribed thereto in Section 3.5(a);

Take-Over Date" means the date on which the Take-Over occurs.

"Taxes and Charges" means the general or special rates, taxes, Value Added Tax (VAT), charges, duties, assessments, impositions, imposts, levies, charges or outgoings whatsoever that are levied by any Government Authority in accordance with the Laws of Bangladesh on and after the Possession Date upon the Demised Premises or upon the owner or occupier in respect thereof or upon the Facility or upon the owner or occupier in respect thereof, including without limitation rates and taxes for the provision of water, sewage and electricity, value-added taxes and any other services or utilities under the Laws of Bangladesh;

"Term" bears the meaning ascribed thereto in Section 2;

"Termination Notice" means a written notice issued by APSCL or the Company, as the case may be, terminating this Lease Agreement, under Section 7.3(c);

"Transferee" bears the meaning ascribed thereto in Section 6.2(d); and

"Transportation Facilities" bears the meaning ascribed thereto in the Gas Supply Agreement.

1.2 Rules of Interpretation

In this Lease Agreement,

(a) the headings are for convenience only and shall be ignored in construing this Lease Agreement;

(b) the singular includes the plural and vice versa;

(c) references to Sections and Schedules are, unless stated to the contrary, references to Sections and Schedules of this Lease Agreement;

(d) the words "include", "including" and "in particular" shall be construed as being by way of illustration or emphasis only and shall not be construed as, nor shall they be given the effect of, limiting the generality of any preceding words;

(e) unless otherwise provided herein, whenever a consent or approval is required hereunder by one Party from the other Party, such consent or approval shall not be unreasonably withheld or delayed; and

(f) in carrying out its obligations and duties under this Lease Agreement, each Party shall have an implied obligation of good faith.

SECTION 2: TERM

2.1 Term

This Lease Agreement shall be effective upon the Project Effective Date and shall, unless terminated earlier in accordance with the terms of this Lease Agreement, continue in full force and effect until the earlier of (i) One year after the last Day of the term of the Power Purchase Agreement (as such agreement may be extended), and (ii) the date upon which the Facility is transferred to the GOB or its designee pursuant to Section 14.1 of the Implementation Agreement (the "**Term**").

2.2 Scheduled Possession Date

APSCL shall deliver to the Company exclusive and continuing possession of the Demised Premises and non-exclusive, free and unfettered use of the Access Road and the portion of the land for the Extended Access Road on or before the date that is not later than thirty (30) Days following the date that the Company delivers a request in writing to APSCL for possession of the Demised Premises, which request may not be delivered by the Company to APSCL prior to the Take Over Date (the "**Scheduled Possession Date**"). The delivery of possession and use of the Demised Premises shall be made in accordance with, and subject to, Section 3.5 and the other provisions of this Lease Agreement.

2.3 Possession Date

The date on which APSCL delivers to the Company exclusive and continuing possession of the Demised Premises and non-exclusive, free and unfettered use of the Access Road and the portion of the land for Extended Access Road in accordance with the provisions of this Lease Agreement shall be the "**Possession Date**", *provided*, that the Possession Date shall not occur unless and until Take-Over has occurred in accordance with, and the Company has complied with the requirements of, Section 3.5;

SECTION 3: OBLIGATIONS OF THE COMPANY AND APSCL

3.1 Demise and Registration

(a) Demise

In consideration of the Rent paid and the covenants of the Company hereinafter contained, APSCL hereby demises to the Company the Demised Premises and grants to the Company non-exclusive, free and unfettered use of the Access Road and the Extended Access Road (following the completion and hand over of possession of the road by the Company to APSCL pursuant to Sections 3.4(a) and (b)) for the duration of the Term in accordance with the terms and conditions set out in this Lease Agreement.

(b) Registration

APSCL shall procure the registration of this Lease Agreement under the Registration Act, 1908 (Act XVI of 1908) and provide to the Company, by no later than the date ten (10) Days prior to the Required Financial Closing Date, satisfactory evidence that such registration has been completed. APSCL acknowledges that the Company is exempted from any registration fees and duties and stamp duties pursuant to Section 12.1 of the Implementation Agreement and, accordingly, such registration shall be at no cost to the Company.

3.2 Rent

In consideration for the lease by APSCL to the Company of the Demised Premises and the grant of non-exclusive, free and unfettered use of the Extended Access Road (following the handover of the completed Extended Access Road by the Company to APSCL pursuant to Sections 3.4(a) and (b)) and the Access Road during the Term, the Company has agreed to provide a credit against (reduction in) the consideration payable by APSCL for the purchase by it of the specified Ordinary Share Capital under and pursuant to the Share Purchase Agreement. No additional payment of Rent by the Company during the Term is required hereunder.

3.3 Payment of Taxes and Charges

The Company shall promptly and regularly pay to the appropriate Government Authority all Taxes and Charges payable in connection with the Demised Premises or the Facility on and from the Possession Date until the expiry of the Term.

3.4 Access Road and Extended Access Road

(a) The Company shall improve and upgrade the Access Road to a standard sufficient for the Company to perform its obligations under the Power Purchase Agreement and in accordance with the terms of this Lease Agreement. The Company shall within three (3) months following the Possession Date construct at its own cost and in accordance with Road Specifications the Extended Access Road up to the Demised Premises. Upon completion of the Extended Access Road, the Company shall hand over the completed Extended Access Road to APSCL and the risk and responsibility for the Extended Access Road shall pass to APSCL from the time of the hand over.

(b) APSCL hereby grants to the Company the right to the non-exclusive, free and unfettered use of the Access Road and, following the hand over of the completed Extended Access Road by the Company to APSCL pursuant to Sections 3.4(a) and (b), the Extended Access Road throughout the Term.

(c) APSCL shall throughout the Term maintain clear and unencumbered title (free of all mortgages and Liens) to the Extended Access Road and the Access Road.

(d) APSCL shall at its own cost throughout the Term maintain the Access Road and, following the hand over of the completed Extended Access Road by the Company to APSCL pursuant to Sections 3.4(a), the Extended Access Road, each to a standard sufficient to permit the Company to perform its obligations under the Power Purchase Agreement and in accordance with the terms of this Lease Agreement.

3.5 Take-Over

(a) APSCL shall, after a joint inspection with the Company, hand over use and exclusive possession of the Demised Premises to the Company (the **"Take-Over"**) not later thirty (30) days following the delivery by the Company to APSCL of a written request for Take Over of the Demised Premises by the Company, which request may not be delivered by the Company prior to the Project Effective Date. After the Take-Over and prior to occurrence of the Possession Date, the Company shall install permanent posts to demarcate the boundary of the Demised Premises and install a security fence on the perimeter of the Demised Premises.

(b) At any time, on and after the Take-Over Date and prior to the Possession Date, the Company shall be entitled to enter the Demised Premises for the purpose of carrying out such surveys, site investigations and other inspections as the Company considers necessary; *provided* that the Company has given APSCL reasonable advance written notice of such intention to enter the Demised Premises.

3.6 Permitted Use, Development and Remedy of Defects

(a) Permitted Use

The Company shall use the Demised Premises, the Extended Access Road, and the Access Road for the purposes of the Project and for the generation and sale of electric generation capacity or electric energy or both and uses reasonably incidental thereto.

(b) Permitted Development and Maintenance Work by the Company

The Company shall, during the Term, carry out work to develop the Demised Premises, the Access Road and the Extended Access Road, and maintain the Demised Premises including, without limitation, clearing, leveling, compacting and filling of the Demised Premises, the Extended Access Road and building the Facility, the Access Road, roads, waterways and wells on, through, above and below the ground or on any part of it on which the Facility, the Access Road or the Extended Access Road or any part of them is to be built, including without limitation providing any materials, facilities or equipment which may be required by the Company and its Contractors for carrying out work and for accommodation of the Company and its Contractors.

(c) Compliance with Law

The Company agrees that it will not use or permit any person to use the Demised Premises, the Extended Access Road, or any portion thereof, in a manner that contravenes any provision of the Laws of Bangladesh.

(d) Articles of Value

All fossils, coins, articles of value or antiquity structures and any other remains of geological or archaeological interest discovered on the Demised Premises, the Extended Access Road shall, as between APSCL and the Company be deemed to be the absolute property of APSCL, and the Company shall at its own expense take all necessary precautions to prevent its employees, representatives and Contractors or other persons from removing or damaging any such article or thing and shall immediately upon discovery thereof, and before removal, acquaint APSCL with such

discovery, comply with all requirements of the Laws of Bangladesh pertaining to the same or, if no such requirements relate, comply with the reasonable instructions of APSCL as to the disposal or preservation of the same.

(e) Repairs and Maintenance

Except as may be provided to the contrary in this Lease Agreement, APSCL shall not be required to make any repairs or improvements to the Demised Premises during the Term, or in any manner to supply maintenance for the Demised Premises or any improvements thereon.

(f) Unexploded Ordnance and Contamination

If unexploded ordnance or other contamination likely to be harmful is discovered on the Demised Premises, the Extended Access Road, the Company will, without prejudice to the Company's right to indemnification from APSCL pursuant to Section 5.2(a), at its own cost and in accordance with the Environmental Guidelines and the Laws of Bangladesh, be responsible for rendering safe the Demised Premises, the Extended Access Road, as the case may be, by the clearance of the contamination or the removal and the subsequent destruction or by in situ destruction of any unexploded ordnance. APSCL shall use reasonable efforts to assist the Company and any Contractors in connection with the clearance of contamination and the removal and destruction of unexploded ordinance.

(g) Site Safety

The Company shall, and shall ensure that its employees, representatives and Contractors and other persons allowed on to the Demised Premises, the Extended Access Road by it shall comply with the safety and site requirements applicable from time to time.

3.7 Insurance

(a) The Company shall at all times while the Power Purchase Agreement is in effect obtain and maintain insurance in accordance with Section 14 of the Power Purchase Agreement.

(b) The Company will name APSCL as an additional insured to the extent of APSCL's insurable interest under the insurance policies required to be maintained pursuant to Section 3.7(a) as required under Section 14 of the Power Purchase Agreement.

3.8 Quiet Enjoyment

APSCL covenants that, *provided* that the Company complies with the terms of this Lease Agreement, the Company shall not be impaired or otherwise prevented by APSCL from using the Demised Premises and the Access Road for the purposes set out in this Lease Agreement and may peaceably enjoy the Access Road and the Demised Premises from the Possession Date until the end of the Term.

3.9 Easement Rights

(a) **Electrical Interconnection Facilities**

APSCL shall, upon written request by the Company which shall not be made earlier than thirty (30) Days after the Project Effective Date, grant to the Company easements and rights-of-way as are necessary to install the Electrical Interconnection Facilities, tele-metering and telecommunication facilities and any other facilities necessary for the Project.

(b) Easements and Rights-of-Way for Transportation Facilities

APSCL shall, upon request by the Company which shall not be made earlier than thirty (30) Days after the Project Effective Date, grant to the Company such, easements and rights-of-way as may be necessary for the purposes incidental to the construction and/or the operation of the Transportation Facilities, the Company Transportation Facilities and the Company Communication Facilities.

(c) Additional Easements

APSCL shall, upon request by the Company which shall not be made earlier than thirty (30) Days after the Project Effective Date, grant to the Company such additional easements and rights-of-way as may be necessary for purposes incidental to the construction and/or the operations of the Facility, including but not limited to drainage and construction of water out-take channels (if and to the extent not adversely affecting the operation or maintenance of the existing power plant in close proximity to the Demised Premises).

(d) No Additional Consideration

Consideration for such rights (for both the Company and APSCL in this Section 3.9) shall be the execution of this Lease Agreement and no other consideration shall be required.

SECTION 4: REPRESENT ATIONS, WARRANTIES AND COVENANTS

4.1 Representations, Warranties and Covenants of APSCL

(a) APSCL represents and warrants that:

(i) it has all requisite corporate power and authority to grant the lease, licenses, easements and other rights envisaged under this Lease Agreement and to execute, deliver and perform its obligations under this Lease Agreement:

(ii) the execution, delivery and performance of this Lease Agreement and the consummation of the transactions contemplated hereby have been duly and validly authorized by APSCL and no other proceedings on the part of APSCL are necessary for the grant of this Lease Agreement;

(iii) this Lease Agreement has been duly and validly executed and delivered by APSCL and constitutes a valid and binding commitment of it;

(iv) there is no investigation, inquiry or proceeding concerning any Environmental Matter relating to or affecting the Demised Premises, the Extended Access Road, and so far as APSCL is aware none is pending or threatened nor is there any fact or circumstance existing which might give rise to any of the foregoing;

(b) Covenants of APSCL

APSCL covenants that, as of the Possession Date:

(i) it shall have clear, unencumbered, title (free and clear of all mortgages and Liens other than Permitted Liens) to the Demised Premises, the Extended Access Road;

(ii) the Demised Premises and the Extended Access Road shall not be subject to any adverse estate, right, interest, covenant, restriction, easement, option, right of pre-emption, wayleave, irrevocable license or other right or arrangement in favour of any third party (whether in the nature of a public or private right or obligation or otherwise), nor is there any agreement to give or create any of the foregoing, and all rights of light, air, water and support associated with the Demised Premises, the Extended Access Road are enjoyed fully by APSCL as of right;

(iii) there shall not be any outstanding actions, disputes, claims or demands between APSCL and any third party or between the GOB and any third party affecting APSCL's title to the Demised Premises, the Extended Access Road or its right or ability to enter into this Lease Agreement;

(iv) there shall not be any Environmental Matters relating to or affecting the Demised Premises, the Extended Access Road;

(v) it has provided adequate compensation (as required under the Laws of Bangladesh and the then-applicable guidelines of the World Bank Group) to all persons:

(A) who may have been displaced;

(B) whose land may have been acquired; or

(C) whose livelihood may have been affected,

when the Demised Premises, the Extended Access Road was acquired.

APSCL further covenants that all representations and warranties set out in Section 4.1(a) shall be true and correct, mutatis mutandis, on the Possession Date.

4.2 Representations, Warranties and Covenants of the Company

(a) Representations and Warranties of the Company

The Company represents and warrants to APSCL that:

(i) It is a company validly existing and in good standing under the laws of Bangladesh and it has all requisite power and authority to conduct its business, to own its properties and to execute, deliver and perform its obligations under this Lease Agreement;

(ii) the execution, delivery and performance by it of this Lease Agreement have been duly authorised by all necessary corporate action, and do not and will not:

(A) require any consent or approval of its board of directors, shareholders or partners other than those which have been obtained (evidence of which shall be, if it has not been, delivered to APSCL upon its request); and

(B) to the best of its knowledge, violate or breach any provisions of or constitute a default under its corporate charter or bylaws or other organic documents, any material indenture, contract, or agreement to which it is a party or by which it or its properties may be bound or any material law, rule, regulation, order, writ, judgment, injunction, decree, determination, or award presently in effect having applicability to the Company.

(iii) this Lease Agreement is a valid and binding obligation of the Company; and

(iv) there is no pending or, to the best of the its knowledge, threatened action or proceeding against it before any court, Government Authority, or arbitrator that could reasonably be expected to materially adversely affect the ability of the Company to perform its obligations hereunder, or which could reasonably be expected to affect the legality, validity or enforceability of this Lease Agreement, or any material part thereof.

(b) Covenants of the Company

The Company covenants that, as of the Possession Date:

(i) The Company shall have in full force and effect and continue thereafter to maintain insurance in accordance with Section 14 of the Power Purchase Agreement.

The Company further covenants that all representations and warranties set out in Section 4.2(a) shall be true and correct, mutatis mutandis, as of the Possession Date.

SECTION 5: LIABILITY AND INDEMNIFICATION

5.1 Limitation of Liability

Except as required by Section 5.2, neither Party shall be liable to the other Party in contract, tort, warranty, strict liability or any other legal theory for any indirect, consequential, incidental, punitive or exemplary damages. Neither Party shall have any liability to the other Party except pursuant to, or for breach of, this Lease Agreement; *provided, however,* that this provision is not intended to constitute a waiver of any rights of one Party against the other with regard to matters unrelated to this Lease Agreement or any activity not contemplated by this Lease Agreement.

5.2 Indemnification

(a) APSCL shall bear responsibility for (i) loss of or damage to property, death or injury to person (or any claim against the Company or its Contractors or their respective officers, directors and employees in respect thereof) and all expenses relating thereto (including without limitation reasonable legal fees) suffered by the Company or its Contractors or its respective officers, directors and employees in connection with the Facility resulting from any negligent or intentional act or omission of APSCL (or it officers, directors, members (of the board) and employees), without recourse to the Company or its Contractors, and (ii) any Loss arising out of or in connection with any Hazardous Material or any Environmental Matter which was present at the Demised Premises prior to the Possession Date or any failure by APSCL to comply with the Laws of Bangladesh (insofar as they relate to Environmental Matters), or the Environmental Guidelines. APSCL will hold the Company or its Contractors fully indemnified in respect thereof. This indemnity shall not extend to any loss, damage, death or injury (or any claim in respect thereof) or any expenses relating thereto to the extent that it was caused by any act or omission of the Company or its Contractors or the failure of the Company or its Contractors to take reasonable steps in mitigation thereof. Notwithstanding anything to the contrary contained in the preceding sentence, nothing in this Section 5.2(a) shall apply to any loss, damage, cost or expense in respect of which, and to the extent that, the Company or its Contractors are compensated pursuant to the terms of any policy of insurance, agreement or through any other means.

(b) The Company shall bear responsibility for (i) loss of or damage to property, death or injury to person (or any claim against APSCL or its respective officers, directors, members (of the board) and employees in respect thereof) and all expenses relating thereto (including without limitation reasonable legal fees) suffered by APSCL or its respective officers, directors, members (of the board) and employees in connection with the Facility resulting from any negligent or intentional act or omission of the Company or its Contractors (or its respective officers, directors and employees), without recourse to APSCL, and (ii) any Loss arising out of or in connection with any Environmental Liabilities arising as a result of any act or omission by the Company or any failure by the Company to comply with the Laws of Bangladesh (insofar as they relate to Environmental Matters), or the Environmental Guidelines. The Company will hold APSCL fully indemnified in respect thereof. This indemnity shall not extend to any loss, damage, death or injury (or any claim in respect thereof) or any expenses relating thereto to the extent that it was caused by any act or omission of APSCL or the failure of APSCL to take reasonable steps in mitigation thereof. Notwithstanding anything to the contrary contained in the preceding sentence, nothing in this Section 5.2(b) shall apply to any loss, damage, cost or expense in respect of which, and to the extent that, APSCL is compensated pursuant to the terms of any policy of insurance, agreement or through any other means.

(c) In the event that any Loss results from the joint or concurrent negligent or intentional acts of the Parties, each shall be liable under this indemnification in proportion to its relative degree of fault.

(d) The provisions of this Section 5.2 shall survive for a period of five (5) years following the termination of this Lease Agreement,

5.3 Assertion of Claims

Neither Party shall be entitled to assert any claim for indemnification until such time as all claims of such Party for indemnification under this Lease Agreement exceed an amount equal to the sum of one hundred thousand Dollars (US$100,000), in the aggregate, at which time all claims of such Party for indemnification under this Lease Agreement may be asserted; *provided, however,* that when such claims have been asserted the same rule shall apply in respect of future claims. Notwithstanding the preceding sentence, either Party may assert a claim for indemnification regardless of amount upon the expiry or earlier termination of this Lease Agreement or if such claim would otherwise be barred by the applicable statute of limitations.

5.4 Defence of Claims

(a) Each Party shall promptly notify the other Party of any loss of, or damage to property, death or injury to person (or any claim or proceeding in respect thereof) in respect of which it is or may be entitled to indemnification under Section 5.2, Such notice shall be given as soon as reasonably practicable after the relevant Party becomes aware of such loss, damage, death or injury (or any claim or proceeding in respect thereof);

(b) The indemnified Party shall have the right, but not the obligation, to contest, defend and litigate any claim, action, suit or proceeding by any third party alleged or asserted against such party in respect of, resulting from, related to or arising out of any matter for which it is entitled to be indemnified hereunder, and the reasonable costs and expenses thereof shall be subject to the indemnification obligations of the indemnifying Party hereunder *provided, however,* that if the indemnifying Party acknowledges in writing its obligations to indemnify the indemnified Party in respect of loss to the full extent provided by Section 5.2, the indemnifying Party shall be entitled, at its option, to assume and control the defence of such claim, action, suit or proceeding at its expense and through counsel of its choice if it gives prompt notice of its intention to do so to the indemnified Party and reimburses the indemnified Party for the reasonable costs and expenses incurred by the indemnified Party prior to the assumption by the indemnifying party of such defence.

(c) Neither Party shall settle or compromise any such claim, action, suit or proceeding without the prior written consent of the other Party, which consent shall not be unreasonably withheld or delayed; *provided,* that after agreeing in writing to indemnify the indemnified Party, the indemnifying Party may settle or compromise any claim without the prior approval of the indemnified Party.

(d) Notwithstanding the foregoing, the indemnified Party shall have the right to employ its own counsel and such counsel may participate in such action, but the fees and expenses of such counsel shall be at the expense of such indemnified Party, when and as incurred unless:

(i) the employment of counsel by such indemnified Party has been authorised in writing by the indemnifying Party;

(ii) the indemnified Party shall have reasonably concluded that there may be a conflict of interest between the indemnifying Party and the indemnified Party in the conduct of the defence of such action;

(iii) the indemnifying Party shall not in fact have employed independent counsel reasonably satisfactory to the indemnified Party to assume the defence of such action and shall have been so notified by the indemnified Party; or

(iv) the indemnified Party shall have reasonably concluded and specifically notified the indemnifying Party either that there may be specific defences available to it which are different from or additional to those available to the indemnifying Party or that such claim, action, suit or proceeding involves or could have a material adverse effect upon it beyond the scope of this Lease Agreement.

(e) If paragraph (ii), (iii) or (iv) of subparagraph (d) above shall be applicable, then counsel for the indemnified Party shall have the right to direct the defence of such claim, action, suit or proceeding on behalf of the indemnified Party and the reasonable fees and disbursements of such counsel shall constitute legal or other expenses hereunder.

SECTION 6: ASSIGNMEN T AND SECURITY

6.1 Assignment

This Lease Agreement may not be assigned by either Party other than by mutual agreement between the Parties in writing.

6.2 Creation of Security

(a) Notwithstanding the foregoing, for the purpose of financing the Facility, the Company may assign to, or grant a security interest in favour of, the Lenders in its rights and interests under or pursuant to: (i) this Lease Agreement, (ii) any agreement or document included within the Security Package, (iii) the Demised Premises, (iv) the Extended Access Road and the Access Road, (v) the movable, immovable and intellectual property of the Company, or (vi) the revenues or any of the rights or assets of the Company. The Company shall not create any security over its rights and interests under this Lease Agreement without the prior written consent of APSCL except as already provided above.

(b) The Lenders shall have no obligation to APSCL under this Lease Agreement until such time as the Lenders or their designees succeed to the Company's interests under this Lease Agreement, whether by exercise of their rights or remedies under the Financing Documents or otherwise, in which case the Lenders or their designees shall give written notice of such succession (a "**Succession Notice**") to APSCL and assume liability for all of the Company's obligations under this Lease Agreement, including without limitation payment of any amounts due and owing to APSCL for payment defaults by the Company under this Lease Agreement (other than, so long as the liability insurance required by Section 3.7 has been and is in effect), damages or penalties incurred by the Company under Section 5.2(b), arising during the period prior to the Lenders' or such designees' succession to the Company's interests in and under this Lease Agreement, *provided* that any liability of the Lenders or their designees shall be strictly limited to the Lenders' interest in the Demised Premises, the Extended Access Road, the Access Road.

Except as otherwise set forth in the immediately preceding sentence, none of the Lenders or their designees shall be liable for the performance or observance of any of the obligations or duties of the Company under this Lease Agreement, nor shall the assignment by the Company of this Lease Agreement to the Lenders give rise to any duties or obligations whatsoever on the part of any of the Lenders owing to APSCL.

(c) Upon notification by the Lenders or the Agent to APSCL of the occurrence and continuance of an event of default under the Financing Documents and the succession of the Lenders to the Company's interests in and under this Lease Agreement, the Lenders shall have the right, among others, to: (i) take possession of the Demised Premises and use the same and the Access Road, the Extended Access Road, for the purposes permitted under this Lease Agreement; and (ii) cure any continuing Company Event of Default under this Lease Agreement as provided in Section 7.1(a).

Notwithstanding the foregoing, upon the delivery of a Succession Notice, the Lenders shall have no obligation to cure any Company Event of Default occurring before the delivery of such Succession Notice that is not capable of being cured and no right will exist for APSCL to terminate this Lease Agreement based upon such Company Event of Default occurring prior to the delivery of the Lenders' Succession Notice.

Without the requirement of obtaining any further consent from APSCL, upon the exercise by the Lenders or their designees of any of the remedies set forth in the Financing Documents, the Lenders may assign their rights and interests and the rights of the Company under this Lease Agreement to a Transferee acceptable to the

GOB so long as such Transferee shall assume all of the obligations of the Company under this Lease Agreement.

Upon such assignment and assumption, the Lenders shall be relieved of all obligations under this Lease Agreement arising after such assignment and assumption.

(d) As used herein, a "**Transferee**" shall be a person who: (i) is a company organized under the Laws of Bangladesh, (ii) either is an experienced and qualified power plant operator or who shall have agreed to engage the services of a person who is an experienced and qualified power plant operator, (iii) shall have paid all amounts, if any, then due and payable to APSCL under this Lease Agreement, and (iv) shall have expressly assumed in writing for the benefit of APSCL the ongoing obligations of the Company under this Lease Agreement.

(e) At the request of the Company, delivered to APSCL not less than thirty (30) Days in advance, APSCL shall execute and deliver at the Financial Closing, all such acknowledgments to the Lenders or their designees of any security created in accordance with this Section 6.2 as are reasonably requested by the Company and the Lenders to give effect to the foregoing

(f) Notwithstanding the foregoing, APSCL shall have the right to assign this Lease Agreement to PGCB or any other entity or entities assuming all or part of APSCL's rights and obligations pursuant to the Power Purchase Agreement; *provided*, that the GOB without interruption guarantees the performance of PGCB or such other succeeding entity or entities on the same terms and conditions as the Guarantee or such other commercial security is provided for the obligations of the succeeding entity or entities that in the reasonable business judgment of the Company provides an adequate alternative to the Guarantee and all of APSCL's obligations under this Lease Agreement are assigned pursuant to law to or contractually assumed, through a novation, by one or more entities, each of which has the legal capacity and appropriate commercial function to perform such obligations.

SECTION 7: TERMINATION

7.1 Company Events of Default -- Termination by APSCL

(a) APSCL may give notice of default under this Lease Agreement (a **"APSCL Notice of Default")** upon the occurrence of any of the following events **("Company Event of Default")**; *provided*, that any such event shall not be a Company Event of Default if it results from a breach (a) by APSCL of this Lease Agreement or the Share Purchase Agreement (b) by BPDB of the Power Purchase Agreement (c) by the GOB of the Implementation Agreement or the Guarantee, or (d) by the Gas Supplier of the Gas Supply Agreement:

(i) any statement, representation or warranty by the Company in this Lease Agreement proving to have been incorrect, in any material respect, when made or when deemed to have been made and the circumstances that cause such failure or incorrect statement, representation or warranty to be incorrect having a material and adverse effect on APSCL's ability to perform its obligations under this Lease Agreement;

(ii) the failure of the Company to perform its obligations under Sections 3.4(a) and (b) in accordance with the times specified therein for such performance save to the extent that such failure is attributable to the occurrence of a Force Majeure Event;

(iii) any other material breach by the Company of this Lease Agreement that is not remedied within thirty (30) Days after notice from APSCL stating that a material breach of this Lease Agreement has occurred and is continuing that could result in the termination of this Lease Agreement, identifying the material breach in question in reasonable detail, and demanding remedy thereof;

(iv) a termination of the Implementation Agreement as a result of any cause other than a GOB Event of Default or a termination of the Power Purchase Agreement as a result of any cause other than a BPDB Event of Default thereunder or a termination of the Gas Supply Agreement as a result of any cause other than a Gas Supplier Event of Default thereunder, and in either case the GOB acquires all of the Company's rights, title and interests in and to the Facility pursuant to the provisions of the Implementation Agreement; or

(v) the failure by the Company to make any payment of any charges or payments required to be made by it hereunder within thirty-five (35) Days of the due date therefor.

7.2 APSCL Events of Default --Termination by the Company

(a) The Company may give a notice of default under this Lease Agreement (a "Company **Notice of Default")** upon the occurrence of any of the following events **("APSCL Event of Default")**; *provided*, that any such event shall not be a APSCL Event of Default if it results from a breach by the Company of this Lease Agreement, the Power Purchase Agreement, the Implementation Agreement or the Gas Supply Agreement or by the Initial Shareholders of the Share Purchase Agreement:

(i) any statement, representation or warranty by APSCL in this Lease Agreement proving to have been incorrect, in any material respect, when made or when deemed to have been made and the circumstance that cause such failure or incorrect statement, representation or warranty to be incorrect having a material and adverse effect on the Company's ability to perform its obligations under this Lease Agreement;

(ii) any material breach by APSCL of this Lease Agreement that is not remedied within thirty (30) Days after notice from the Company to APSCL stating that a material breach of this Lease Agreement has occurred and is continuing that could result in termination of this Lease Agreement, identifying the material breach in question in reasonable detail, and demanding remedy thereof;

(iii) the Possession Date does not occur within thirty (30) Days of the Financial Closing Date; or

(iv) a termination of the Implementation Agreement due to a GOB Event of Default or a termination of the Power Purchase Agreement due to a BPDB Event of Default thereunder or a termination of the Gas Supply Agreement due to a Gas Supplier Event of Default thereunder.

7.3 Rights and Remedies Upon an Event of Default

(a) **Notice of Intent to Terminate**

(i) Upon the occurrence of a APSCL Event of Default or a Company Event of Default, as the case may be, that is not cured within the applicable period (if any) for cure, the non-defaulting Party may, at its option, initiate termination of this Lease Agreement by delivering a notice (a "**Notice of Intent to Terminate**") of its intent to terminate this Lease Agreement to the defaulting Party.

(ii) The Notice of Intent to Terminate shall specify in reasonable detail the Company Event of Default or APSCL Event of Default, as the case may be, giving rise to the Notice of Intent to Terminate.

(b) **Consultation**

(i) Following the delivery of a Notice of Intent to Terminate, the Parties shall consult for a period of:

(A) forty-five (45) Days in case of a failure by either Party to make payments when due, and

(B) ninety (90) Days with respect to any other Event of Default (or in each case such longer period as the Parties mutually may agree)

as to what steps shall be taken with a view to resolving or mitigating the consequences of the relevant Event of Default:

(ii) Notwithstanding any such consultations, during the period following the delivery of the Notice of Intent to Terminate, the Party in default may continue to undertake efforts to cure the default, and if the default is cured at any time prior to the delivery of a Termination Notice in accordance with Section 7.3(c), then the non-defaulting Party shall have no right to terminate this Lease Agreement in respect of such cured default.

(c) **Termination Notice**

Subject to the provisions of Sections 7.4 and 7.6, as the case may be, upon expiration of the consultation period described in Section 7.3(b) and unless the Parties shall have otherwise agreed or unless the Event of Default giving rise to the

Notice of Intent to Terminate shall have been remedied, subject to Section 7.4 or Section 7.5, as the case may be, the Party having given the Notice of Intent to Terminate may terminate this Lease Agreement by delivery of a Termination Notice to the other Party, whereupon this Lease Agreement shall immediately terminate immediately upon delivery of such notice to such other Party.

7.4 Notice to Lenders of Company Event of Default

(a) No Termination Without Notice to Lenders

Notwithstanding anything in this Lease Agreement, from and after the occurrence of the Financial Closing Date APSCL shall not seek to terminate this Lease Agreement without first giving to the Lenders a copy of any notices given to the Company under Sections 7.1 and 7.3, such notice to be coupled with a request to the Lenders to cure any such default within the cure period specified in Section 7.3(b) (the **"Initial Cure Period"**), which period shall commence upon delivery of each such notice to the Lenders.

(b) Designation of Agent and Notification Procedure

(i) The Lenders will designate in writing to APSCL an agent (the **"Agent"**) and any notice required hereunder shall be delivered to such Agent, such notice to be effective upon delivery to the Agent as if delivered to each of the Lenders.

(ii) Each such notice shall be in writing and shall be deemed to have been delivered:

(A) when presented personally to the Lenders or the Agent:

(B) when transmitted by APSCL and received by the Lenders or the Agent by facsimile to the number specified in accordance with the procedure set forth below; or

(C) five (5) Days after being deposited in a regularly maintained receptacle for the postal service in Bangladesh, postage prepaid, registered or certified, return receipt requested, addressed to the Lenders at the address indicated at Financial Closing (or such other address or to the Agent at such address as the Lenders may have specified by written notice delivered in accordance herewith).

Any notice given by facsimile under this Section 7.4 shall be confirmed in writing delivered personally or sent by prepaid post, but failure to so confirm shall not void or invalidate the original notice if it is in fact received by the Lender or the Agent.

(iii) Notwithstanding the foregoing, if the address of the Lenders or Agent is outside Bangladesh, any notice delivered to the Lender or Agent pursuant to this Section 7.4 shall be:

(A) presented personally or sent by international courier or facsimile; and

(B) if sent by facsimile, confirmed by international courier,

and the Initial Cure Period shall commence upon receipt by the Lenders or the Agent of the notice referenced above.

(iv) The address and facsimile number for the Lenders or Agent shall be provided to APSCL by the Company at Financial Closing and thereafter may be changed by the Lenders or the Agent by subsequent delivery of a notice to APSCL at the address or facsimile number of APSCL set out in Section

10.1(a) (or at such other address or facsimile number in accordance with Section 7.4(b)(i)) and otherwise in accordance with the requirements of Section 10.1.

(c) Termination Not Valid Without Notice to Lenders

(i) From and after Financial Closing no rescission or termination of this Lease Agreement by APSCL (other than as a result of a Company Event of Default under Section 7.1(a)(iv)) shall be valid or binding upon the Lenders without such notice, until the expiration of:

(A) the Initial Cure Period;

(B) the Evaluation Period provided in Section 7.4(d); and

(C) if applicable, the Lenders Cure Period, provided in Section 7.4(e), as such Lenders Cure Period may be extended.

(ii) The Lenders may make, but shall be under no obligation to make any payment or perform or procure the performance of any act required to be made or performed by the Company, with the same effect as if made or performed by the Company.

(d) **Failure of Lenders to Cure Default**

If the Lenders fail to cure or are unable or unwilling to cure any Company Event of Default that is required to be cured prior to the expiration of periods referred to above in this Section 7.4, APSCL shall have all its rights and remedies with respect to such default as set forth in this Lease Agreement; *provided*, that:

(i) upon the expiration of the Initial Cure Period, the Lenders shall have a further period (the "**Evaluation Period**") during which the Lenders may evaluate such Company Event of Default, the condition of the Facility, and other matters relevant to the actions to be taken by the Lenders concerning such Company Event of Default, and

(ii) the Evaluation Period shall end on the sooner to occur of:

(A) the delivery by the Lenders to APSCL of a notice that the Lenders have elected to procure the cure of such Company Event of Default or otherwise pursue their remedies under the Financing Documents (an "**Election Notice**"); and

(B) thirty (30) Days following the end of the Initial Cure Period.

During the Evaluation Period, APSCL's rights and remedies with respect to a Company Event of Default shall be suspended.

(e) **Delivery of Election Notice**

(i) Upon the delivery of the Election Notice, the Lenders shall be permitted an additional period of one hundred and eighty (180) Days to cure any Company Event of Default (the "**Lenders Cure Period**").

(ii) During such Lenders Cure Period, APSCL's right to terminate this Lease Agreement shall be suspended so long as Lenders are diligently:

(A) attempting to procure (other than by the Company, unless the Company is acting at the direction of the Lenders) the cure of such default; or

(B) pursuing the enforcement of their rights a nd remedies under the Financing Documents against the Company.

(f) **Expiry of Cure Period**

In the event that the Lenders fail to cure any Company Event of Default on or before the expiration of the Lenders Cure Period, APSCL may exercise its rights and remedies with respect to such default set forth in this Lease Agreement and APSCL may immediately terminate this Lease Agreement, and such termination shall be effective on delivery to the Lenders or the Agent of notice of such termination.

7.5 Notice to the GOB of APSCL's Default

(a) **No Termination Without Notice to the GOB**

Notwithstanding anything in this Lease Agreement, the Company shall not seek to terminate this Lease Agreement as a result of any default of APSCL without first giving a copy of any notices given to APSCL under Sections 7.2 and 7.3 to the GOB, such notices to be coupled with a request to the GOB to cure any such default within the same cure period as provided to APSCL hereunder and such cure period to commence upon delivery of each such notice to the GOB.

(b) **Notification Procedure**

Each such notice shall be deemed to have been delivered: (i) when presented personally to the GOB, (ii) when transmitted by facsimile, or (iii) five (5) Days after being deposited in a regularly maintained receptacle for the postal service in Bangladesh, postage prepaid, registered or certified, return receipt requested, addressed to the GOB, at the address indicated in Section 17 of the Implementation Agreement (or such other address as the GOB may have specified by written notice delivered in accordance therewith).

Any notice given by facsimile under this Section 7.5 shall be confirmed in writing delivered personally or sent by prepaid post, but failure to so confirm shall not void or invalidate the original notice if it is in fact received by the GOB.

(c) **Termination Not Valid Without Notice to the GOB**

(i) No rescission or termination of this Lease Agreement by the Company shall be of any effect without such notice and expiration of such cure period.

(ii) The GOB may make or perform, but shall be under no obligation to make any payment (other than as required under the Guarantee) or to perform any act required of APSCL hereunder with the same effect as if the payment or act had been made or performed by APSCL

(d) **Failure to Cure Default**

If the GOB fails to cure or is unable or unwilling to cure a APSCL Event of Default within the cure periods provided to APSCL under this Lease Agreement, the Company shall have all its rights and remedies with respect to such default as set forth in this Lease Agreement; *provided*, that if the GOB is diligently attempting to cure such default, other than a payment default of APSCL, and demonstrable

progress toward effecting such cure is being made, the GOB shall be granted an additional period not exceeding ninety (90) Days to effect such cure before the Company may exercise its rights and remedies with respect to such default set forth in this Lease Agreement.

SECTION 8: RIGHTS AND OBLIGATIONS OF PARTIES UPON TERMINATION

8.1 Obligations Upon Termination

Upon expiration or termination of this Lease Agreement, the Company shall immediately surrender the Demised Premises and the Parties shall have no further obligations hereunder except for obligations that arose prior to such expiration or termination and that expressly survive such expiration or termination pursuant to this Lease Agreement. For each Day following the end of the Term that the Company has not surrendered possession of the Demised Premises, the Company shall be a holdover tenant, and the Company shall pay to APSCL the Rent deemed applicable to the last Contract Year of the Term (equal to Tk. 6.21 million per year), divided by three hundred and sixty-five (365) and multiplied by three (3). The Company irrevocably agrees that this rent is reasonable and constitutes liquidated damages to APSCL and is not and shall not be construed to be a penalty.

8.2 Other Remedies

(a) **Remedies Cumulative**

Except as otherwise provided herein:

(i) the exercise of the right of a Party to terminate this Lease Agreement, as provided herein, does not preclude such Party from exercising other remedies that are provided herein or are available at law or in equity; and

(ii) remedies are cumulative, and the exercise of, or failure to exercise, one or more of them by a Party shall not limit or preclude the exercise of, or constitute a waiver of, other remedies by such Party.

(b) **Limitations of Damages of the Company**

Notwithstanding Section 8.2(a), the Parties agree that the Company may be damaged in amounts that may be difficult or impossible to determine in the event that this Lease Agreement is terminated by the Company as a result of a APSCL Event of Default. Therefore, the Parties have agreed that the termination of this Lease Agreement and the remedies provided therefor under the Implementation Agreement, including, if applicable, the termination of the Implementation Agreement by the Company under Section 13.2 of the Implementation Agreement (and the termination of this Lease Agreement under Section 7.2(a)(iii)) and the payment to the Company by the GOB of the compensation provided under Section 14.1 of the Implementation Agreement as a result thereof, is in lieu of actual damages and any other liquidated damages which may otherwise be payable under this Lease Agreement in respect of such termination and the collection of such amount (and, if applicable, the termination of the Implementation Agreement) is the sole remedy of the Company in respect of such termination. The provisions of this Section 8.2 shall be without prejudice to any right or remedy of the Company which arises prior to termination of this Lease Agreement.

(c) **Limitations of Damages of APSCL**

Notwithstanding the foregoing or any other provision of this Lease Agreement, the Parties agree that, in the event that APSCL terminates this Lease Agreement as a result of a Company Event of Default under Section 7.1(a)(iii) and the GOB elects to purchase the Facility and the Company transfers the Facility to the GOB pursuant to Section 14.1 of the Implementation Agreement, upon such transfer and payment by the GOB of the compensation provided under Section 14.1 of the Implementation Agreement, any claims by APSCL against or liability of the Company under this Lease Agreement (except as provided in Section 8.1) shall be fully extinguished and APSCL shall have no further claim or recourse against the Company under this Lease

Agreement. The provisions of this Section 8.2 shall be without prejudice to any right or remedy of the Company which arises prior to termination of this Lease Agreement.

SECTION 9: RESOLUTION OF DISPUTES

9.1 Governing Law

This Lease Agreement and the rights and obligations of the Parties hereunder shall be interpreted, construed and governed by the laws of Bangladesh.

9.2 Resolution by Parties

(a) **Mutual Discussions**

(i) In the event that a Dispute arises, the Parties shall attempt in good faith to settle such Dispute by mutual discussions within thirty (30) Days after the date that the disputing Party gives written notice of the Dispute to the other Party identifying the Dispute in reasonable detail and requesting consultations between the Parties to resolve the Dispute.

(ii) If the Dispute involves the amount of an invoice and after ten (10) Business Days of mutual discussion either Party has determined that further discussion is not likely to resolve the Dispute to its satisfaction, such Party may immediately refer the matter to the Expert for consideration pursuant to Section 9.3.

(b) **Referral to Chief Executive Officer**

(i) In the event that the Dispute is not resolved in accordance with Section 9.2(a), either Party may refer the Dispute to the chief executive officer or chief operating officer of the Company and the designated representative for system operations of APSCL (or such other official authorised by APSCL) for further consideration.

(ii) In the event that such individuals are unable to reach agreement within fifteen (15) Days, or such longer period as they may agree, then either Party may refer the matter to an Expert in accordance with Section 9.3 or, if the Dispute is not of a type required to be referred to an Expert under Section 9.3, commence arbitration of the Dispute in accordance with Section 9.4.

9.3 Mediation by Expert

(a) In the event that the Parties are unable to resolve a Dispute in accordance with Section 9.2, then either Party, in accordance with this Section 9.3, may refer the Dispute to an Expert for consideration of the Dispute and to obtain a recommendation from the Expert as to the resolution of the Dispute.

(b) The Party initiating submission of the Dispute to the Expert shall provide the other Party with a notice stating that it is submitting the Dispute to an Expert and nominating the person it proposes to be the Expert. The other Party shall, within fifteen (15) Days of receiving such notice, notify the initiating Party whether such person is acceptable. If the Party receiving such notice fails to respond or notifies the initiating Party that the person is not acceptable, the Parties shall meet and discuss in good faith for a period of ten (10) Days to agree upon a person to be the Expert. If the Parties are unable to agree within such ten (10) Day period, the Expert shall be selected by the International Chamber of Commerce following a request of either Party.

(c) Consideration of the Dispute by an Expert shall be initiated by the Party who is seeking consideration of the Dispute by the Expert submitting to both the Expert and the other Party written materials setting forth:

(i) a description of the Dispute;

(ii) a statement of the Party's position; and

(iii) copies of records supporting the Party's position.

(d) Within ten (10) Days of the date that a Party has submitted the materials described in Section 9.3(c), the other Party may submit to the Expert:

(i) a description of the Dispute,

(ii) a statement of the Party's position; and

(iii) copies of any records supporting the Party's position.

(e) The Expert shall consider any such information submitted by the responding Party within the period provided in Section 9.3(d) and, in the Expert's discretion, may consider any additional information submitted by either Party at a later date.

(f) The Parties shall not be entitled to apply for discovery of documents, but shall be entitled to have access to the other Party's relevant records and to receive copies of the records submitted by the other Party.

(g) Each Party shall designate one person knowledgeable about the issues in Dispute who shall be available to the Expert to answer questions and provide any additional information requested by the Expert. Except for such person, a Party shall not be required to, but may, provide oral statements or presentations to the Expert or make any particular individuals available to the Expert.

(h) Except as provided in Section 9.3(j) with respect to the payment of costs, the proceedings shall be without prejudice to any Party and any evidence given or statements made in the course of this process may not be used against a Party In any other proceedings. The process shall not be regarded as an arbitration and the laws relating to commercial arbitration shall not apply. Except as expressly provided otherwise in this Lease Agreement or unless the Parties agree in writing signed by both Parties at the time the Expert is selected stating that the decision of the Expert will be binding (in which case the determination of the Expert shall be binding), the determination of the Expert shall not be binding.

(i) When consideration of the Dispute by an Expert is initiated, the Expert shall be requested to provide a recommendation within fifteen (15) Days after the ten (10) Day response period provided in Section 9.3(d) above has run.If the Expert's recommendation is given within such fifteen (15) Day period, or if the Expert's recommendation is given at a later time and neither Party has at such time initiated any other proceeding concerning the Dispute, except for such Disputes where the Expert's determination is final and binding on the Parties, the Parties shall review and discuss the recommendation with each other in good faith for a period of ten (10) Days following delivery of the recommendation before proceeding with any other actions.

(j) If a Party does not accept the recommendation of the Expert with respect to the Dispute, except for such Disputes where the Expert's determination is final and binding on the Parties, it may initiate arbitration proceedings in accordance with Section 9.4; *provided,* that prior to initiating the arbitration proceedings it shall have

paid all costs of the Expert (including the reimbursement of any costs paid to the Expert by the other Party) and all out-of-pocket costs of the other Party. Similarly if the Expert has not submitted its recommendation within the time period provided in Section 9.3(i), a Party may initiate arbitration proceedings in accordance with Section 9.4; *provided,* that prior to initiating the arbitration proceedings it shall have paid all costs of the Expert (including the reimbursement of any costs paid to the Expert by the other Party). Notwithstanding the foregoing provisions of this Section 9.3(j), the Parties shall be bound by the decision of the Expert pending resolution of the Dispute by arbitration and shall not be excused from performance or be entitled to additional time for performance by reason of the Expert's decision and any discrepancy in respect thereof or the instigation of such arbitration.

(k) Except as provided in Section 9.3(j), the costs of engaging an Expert shall be borne equally by the Parties, and each Party shall bear its own costs in preparing materials for, and making presentations to, the Expert.

9.4 Arbitration

(a) The Parties agree to use their best efforts to resolve any dispute or difference arising under, out of, in connection with or relating, to this Agreement, including, without limitation, any dispute or difference concerning the existence, validity or enforceability or interpretation of this Agreement or any provision hereof or the obligations or performance of a Party hereunder or under any provision hereof, or as to whether this Agreement or any provisions hereof (including agreements contained in this Article 9.4) are invalid, illegal or unenforceable (each a "Dispute") through consultation between the Parties. If any such Dispute has not been resolved within ninety (90) Days of the delivery by a Party to the other Party of a written notice, identifying the Dispute in reasonable detail and requesting consultations between the Parties to resolve the Dispute, such Dispute shall be resolved exclusively by means of arbitration in accordance with the Bangladesh Arbitration Act 2001 and the place of arbitration shall be at Dhaka, Bangladesh.

(b) Any arbitral proceeding under this Article 9.4 shall be carried out at Dhaka, Bangladesh.

(c) The Parties agree that the arbitral tribunal constituted in pursuance of a request for arbitration made under Article 9.4(a) shall consist in a sole arbitrator, who shall be a person who has held judicial office for a period of not less than three (3) years in a court of record in Bangladesh or in a jurisdiction whose laws are substantially derived from the common law of Bangladesh. The Parties further agree that, except in the case of an appointment made by the Chairman of the Administrative Council, any person appointed as sole arbitrator need not be a person designated to serve on the Panel of Arbitrators.

(d) No arbitrator appointed pursuant to this Article 9.4 shall be any shareholder or group of shareholders owning directly or indirectly five percent (5%) or more of the Ordinary Share Capital, nor shall any such arbitrator be a shareholder or employee or agent or former employee or agent of, or have or have had any material interest (directly or indirectly) in the business of or in, any Party or such person.

(e) Each Party hereby irrevocably undertakes (i) to treat any arbitral award or procedural order made by the arbitral tribunal constituted pursuant to this Article 9.4 as final and binding and (ii) undertakes to comply with and to carry out any such arbitral award or procedural order, fully and without delay.

(f) Until such time as any arbitral proceedings begun in pursuant of Article 9.4(a) have been finally concluded (and, for this purpose, all rights of appeal, if any, shall have been exhausted), except for proceedings brought exclusively for the purpose of recognition and enforcement of any arbitral award or procedural order made by an arbitral tribunal duly constituted hereunder, each Party irrevocably agrees not to initiate any proceedings, file any action or suit in any court of Bangladesh or before any judicial or other authority arising under, out of, in connection with or relating to this Agreement, the arbitration agreements set forth in this Article 9.4, any Dispute (whether or not any such Dispute shall have been referred to arbitration in pursuance of Article 9.4(a)), the subject matter of any Dispute or any arbitral proceeding begun in pursuance of Article 9.4(a), including without limitation (i) proceedings brought with a view to recourse or appeal against or revision or the annulment of any arbitral award or procedural order made by the arbitral tribunal or (ii) proceedings in which relief or remedy is sought by way of injunction or other judicial order (interlocutory or final) which would have the effect (directly or indirectly) of restraining or impeding the maintenance or prosecution by either Party of any arbitral proceeding initiated in pursuance of Article 9.4(a).

(g) The language of the arbitration shall be in English

9.5 Commercial Acts; Sovereign Immunity; Jurisdiction

(a) APSCL unconditionally and irrevocably agrees that the execution, delivery and performance by it of this Lease Agreement constitute private and commercial acts. In furtherance of the foregoing, APSCL hereby irrevocably and unconditionally agrees that:

(i) should any proceedings be brought against APSCL in Bangladesh or in any jurisdiction where any material assets or property of APSCL is located or against APSCL assets, other than electric generation assets and equipment, electric distribution assets, other any assets or property of a type protected by the diplomatic and consular privileges under the Immunity Act, 1978 of the United Kingdom or the Sovereign Immunities Act, 1976 of the United States or any analogous legislation (collectively, the **"Protected Assets")** to enforce any award or decision of any arbitrator or arbitrators who were duly appointed under this Lease Agreement to resolve a Dispute between the Parties, no claim of immunity from such proceedings will be claimed by or on behalf of APSCL on behalf of itself or any of its assets (other than the Protected Assets).

(ii) it waives any right of immunity which it or any of its assets (other than the Protected Assets) now has or may in the future have in any jurisdiction in connection with any such proceedings; and

(iii) it consents generally to the jurisdiction of any court of competent jurisdiction (including courts in Bangladesh) for any action filed by the Company to enforce any award or decision of any arbitrator who was duly appointed under this Lease Agreement to resolve any Dispute between the Parties (including without limitation, the making, enforcement or execution against or in respect of any of its assets (other than the Protected Assets) regardless of its use or intended use) and specifically waives any objection that any such action or proceeding was brought in an inconvenient forum and agrees not to plead or claim the same. APSCL agrees that service of process in any such action or proceeding may be affected in any manner permitted by the law applicable to the aforementioned court.

9.6 Company's Consent to Jurisdiction

(a) The Company hereby unconditionally and irrevocably consents generally to the jurisdiction with respect to itself and all of its assets and property that it now has or may thereafter acquire of the courts of any competent jurisdiction, including the courts in Bangladesh, for any action or proceeding filed by APSCL to enforce any award or decision of any arbitrator or arbitrators or Expert who were duly appointed under this Lease Agreement to resolve any Dispute between the Parties. The Company waives any objection that it may now or hereafter have to the venue of any action or proceeding brought as consented to in this Section 9.6 and specifically waives any objection that any such action or proceeding was brought in an inconvenient forum and agrees not to plead or claim the same. The Company agrees that service of

process in any such action or proceeding may be affected in any manner permitted by the law applicable to the aforementioned court. The Company irrevocably waives any and all rights it may have to enforce any judgment or claim against the Protected Assets in the courts of any jurisdiction

(b) For the avoidance of doubt any dispute or difference between the Parties as to whether either Party has complied with the affirmation set out in Section 9.5 or this Section 9.6 or both shall be referred for determination under Section 9.3 and shall fall within the definition of Dispute.

SECTION 10: MISCELLA NEOUS PROVISIONS

10.1 Notices

(a) Except as otherwise expressly provided in this Lease Agreement, all notices or other communications to be given or made hereunder shall be in writing, shall be addressed for the attention of the persons indicated below and shall either be delivered personally or sent by courier, registered or certified mail or facsimile. The addresses for service of the Parties and their respective facsimile numbers shall be:

If to the Company: Address:
United Ashuganj Energy Ltd.,
Attention: Managing Director
Fax: +88-02 9893445-6,

If to APSCL:	Ashuganj Power Station Company Limited
Address:	Ashuganj, Brahmanbaria
	Bangladesh
Attention:	Company Secretary
Facsimile:	: +88-08528-74014.
Tel. No.	: +88-08528-74004

(b) All notices shall be deemed delivered when

(i) presented personally;

(ii) if received on a business day for the receiving Party when transmitted by facsimile to the receiving Party's facsimile number specified above; and if received on a Day that is not a Business Day for the receiving Party, on the first Business Day following the date transmitted by facsimile to the receiving Party's facsimile number specified above;

(iii) one (1) Business Day after being delivered to a courier for overnight delivery, addressed to the receiving Party, at the address indicated above (or such other address as such Party may have specified by written notice delivered to the delivering Party at its address or facsimile number specified above in accordance herewith), and

(iv) five (5) Days after being deposited in a regularly maintained receptacle for the postal service in Bangladesh, postage prepaid, registered or certified, return receipt requested, addressed to the receiving Party, at the address indicated above (or such other address as the receiving Party may have specified by written notice delivered to the delivering Party at its address or facsimile number specified above in accordance herewith).

(C) Any notice given by facsimile shall be confirmed in writing delivered personally or sent by registered or certified man, but the failure to so confirm shall not void or invalidate the original notice if it is in fact received by the Party to which it is addressed.

(d) Either Party may by not less than ten (10) days' prior written notice change the addressees and/or addresses to which such notices and communications to it are to be delivered or mailed.

10.2 Amendment

This Lease Agreement can be amended only by agreement between the Parties in writing, executed by a duly authorised representative of each of the Parties.

10.3 Third Parties

This Lease Agreement is intended solely for the benefit of the Parties and, except for rights expressly granted to the Lenders, nothing in this Lease Agreement shall be construed to create any duty or any liability to or any right of suit or action whatsoever, to any person not a Party.

10.4 No Waiver

(a) The failure or delay of either Party to enforce at any time any of the provisions of this Lease Agreement, or to require at any time performance by the other Party of any provision hereof, shall neither be construed to be a waiver of such provisions nor affect the validity of this Lease Agreement or any part hereof or the right of such Party thereafter to enforce each and every such provision.

(b) No waiver by either Party of any default or defaults by the other Party in the performance of any of the provisions of this Lease Agreement:

(i) shall operate or be construed as a waiver of any other or further default or defaults whether of a like or different character; or

(ii) shall be effective unless in writing duly executed by a duly authorised representative of such Party.

10.5 Survival

Cancellation, expiration, termination of this Lease Agreement or arbitration of disputes shall not relieve the Parties of obligations that by their nature should survive such cancellation, expiration or termination, including, without limitation, warranties, remedies, promises of indemnity and confidentiality.

10.6 Language

The language of this Lease Agreement shall be English. All documents, notices, waivers and all other communication written or otherwise between the Parties in connection with this Lease Agreement shall be in English.

10.7 Entirety

This Lease Agreement and the Schedules attached hereto are intended by the Parties as the final expression of their agreement and are intended also as a complete and exclusive statement of the terms of their agreement with respect to the subject matter hereof. All prior written or oral understandings, offers or other communications of every kind are hereby abrogated and withdrawn.

10.8 Successors and Assigns

This Lease Agreement shall be binding upon, and inure to the benefit of, the Parties and their respective permitted successors and permitted assigns.

10.9 Double Jeopardy

A final, non-appealable order issued in a proceeding initiated by the GOB and based on a claim of breach of the Implementation Agreement shall be with prejudice to any proceedings against the Company that APSCL could otherwise bring for breach by the Company of substantially the same obligations under this Lease Agreement. Nothing in this Section 10.9 shall prevent APSCL and the GOB from separately initiating proceedings to terminate this Lease Agreement and the Implementation Agreement, respectively, pursuant to Section 7.4 and Sections 13.1 and 13.3 of the Implementation Agreement.

10.10 Counterparts

This Lease Agreement is executed in English in counterparts and all so executed counterparts shall constitute one agreement binding on both Parties.

10.11 Comments/Vetting

The Comments/Vetting to be provided by the Ministry of Law & Parliamentary Affairs, will be a part of this Contract.

IN WITNESS WHEREOF, the Parties have executed and delivered this Lease Agreement as of the date first above written.

ASHUGANJ POWER STATION COMPANY LIMITED

By: _____
Name: MD. MAHFUZUL HAQUE
Title: EXECUTIVE DIRECTOR
(FINANCE & COMPANY SECRETARY)

[SEAL]

Executive Director (Finance)
&
Company Secretary
Ashuganj Power Station Co. Ltd
Ashuganj, Brahmanbaria

WITNESS _____

Engr. Ajit Kumar Sarker
Project Director
60MW Modular Power Plant Project
Ashuganj Power Station Co. Ltd.

[United Ashuganj Energy Ltd.]

By: _____
Name: MOINUDDIN HASAN RASHID
Title: MANAGING DIRECTOR

[SEAL]

Moinuddin Hasan Rashid
Managing Director
United Ashuganj Energy Ltd.

WITNESS _____

R. Adm BAZLUR RAHMAN (R)
Director, UAEL.

SCHEDULE I: SITE DESCRIPTION

PART A. DESCRIPTION OF THE DEMISED PREMISES

The Demised Premises consist of approximately 6.48 (six point four eight) acres of undeveloped land, which will be provided in "as is" condition. Any and all required leveling, filling to the final elevation, soil compaction, and river bank protection (if applicable) will be performed by the Company.

The Demised Premises are shown in the Plot attached as Annexure I to this Schedule I.

ANNEXURE I TO SCHEDULE I

[TO COME]

SCHEDULE II: RENT PAYMENT TERMS

Under and in accordance with the terms of the Share Purchase Agreement, APSCL has received a credit against (reduction in) the consideration payable by APSCL to the Company for the Ordinary Share Capital it has agreed to purchase, which credit shall be in lieu of payment by the Company to APSCL of the following amounts:

1. The rent payable for the Demised Premises

   The Company shall pay to APSCL total Rent of Tk. 304.08 million within 7 (seven) days of handing over of the land.

Provided that the terms of the Share Purchase Agreement are complied with by APSCL, the Company and the Initial Shareholders, the Company shall have no obligation to make any payment of the Rent cost as provided above.

Annexure IX

Steel Structure Design Code

McDONALD STEEL BUILDING PRODUCTS LIMITED

"Your Partner in Quality Steel Solutions"

ISO 9001 : 2000 Certified Company

PROPOSAL

for

200 MW POWER PLANT

in

ASHUGANJ.

OWNER: UNITED ASHUGANJ ENERGY LTD.

Santa Western Tower" (Level-11th) 186, Biruttam Mir Shawkat Ali Sharak, Tejgaon Industrial Area, Dhaka-1208
Tel: 8878748-51, Fax: 880-2-8878752
E-mail:mcdnld@mcdonaldbd.com,www.mcdonaldbd.com

SECTION-1

1. (a) BUILDING DESCRIPTION :

Nature of Building : **Power Plant, Control Room & Utility Building**

Number : 02 (Two)

1. (b) BUILDING PARAMETERS :

Length (mm)	Width (mm)	Total Floor Area (Sft)	Eave Height (mm)	Roof Slope	Brick Wall / Sand witch Panel	Bay Spacing (mm)	Span
Power Plant							
150400	22800	31600	10000	1:10	**(Not by MSBPL)**	As per drawings..	Single span
Control Room & Utility Building							
21600	22800	15231	As per drawings	Flat	**(Not by MSBPL)**	As per drawings.	As per drawing

1.(c) DESIGN LOADS :

Design Live Load (kN/m^2) on Roof on Engine Hall	=	0.57
Design Dead Load (kN/m^2) on Roof on Engine Hall	=	Self weight
Design Live Load (kN/m^2) on Mezzanine Floor of Utility Building	=	5
Design Dead Load (kN/m^2) on Mezzanine Floor of Utility Building	=	4
Wind Speed (kmph)	=	180
Exposure Type	=	B
Seismic Zone	=	02

Annexure X

Methodology of Monitoring and Analyses

for Air Quality

Methodology of Monitoring and Analyses for Air Quality

1. LOCATION OF DUST (SPM), $PM_{2.5}$ and PM_{10} MONITORING

United Ashuganj Energy Ltd at Ashuganj is situated near Aggreko Power Plant Ltd in Brahmanbaria. The city is known for its power plant which generates much of the electricity for the country especially for the capital city. Ashuganj Fertilizer Ltd is on the southern side of Midland Power Generation Ltd at Ashuganj. It produces chemical fertilizer for the country. This area is known as commercial area. Almost 25% electricity supply from Ashugonj Power Station. In Ashugonj, more than 500 rice mills which means above 40% rice supply from Ashugonj. Ashuganj Fertilizer is a biggest chemical fertilizer company. Ashugonj City is also known as river port. There is also a gas transmission company. The location of the project is shown in Figure 1.

Direction	Location
PM sampling	24° 2.500' N 91° 0.591' E

Figure 1: United Ashuganj Power Generation Ltd, Ashuganj

2. AIR SAMPLING TIME AND LOCATION OF SAMPLING

Construction dust (TSP), PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2 at plant area were monitored from 5 to 31 March 2015. PM_{10} and $PM_{2.5}$ samples were collected every third day in a week. As there is an impact of meteorology during pre-monsoon season and wind blows from south towards north

direction (Figure 2), therefore we have set up the three PM samplers (TSP, PM_{10} and $PM_{2.5}$) in the north side of the plant.

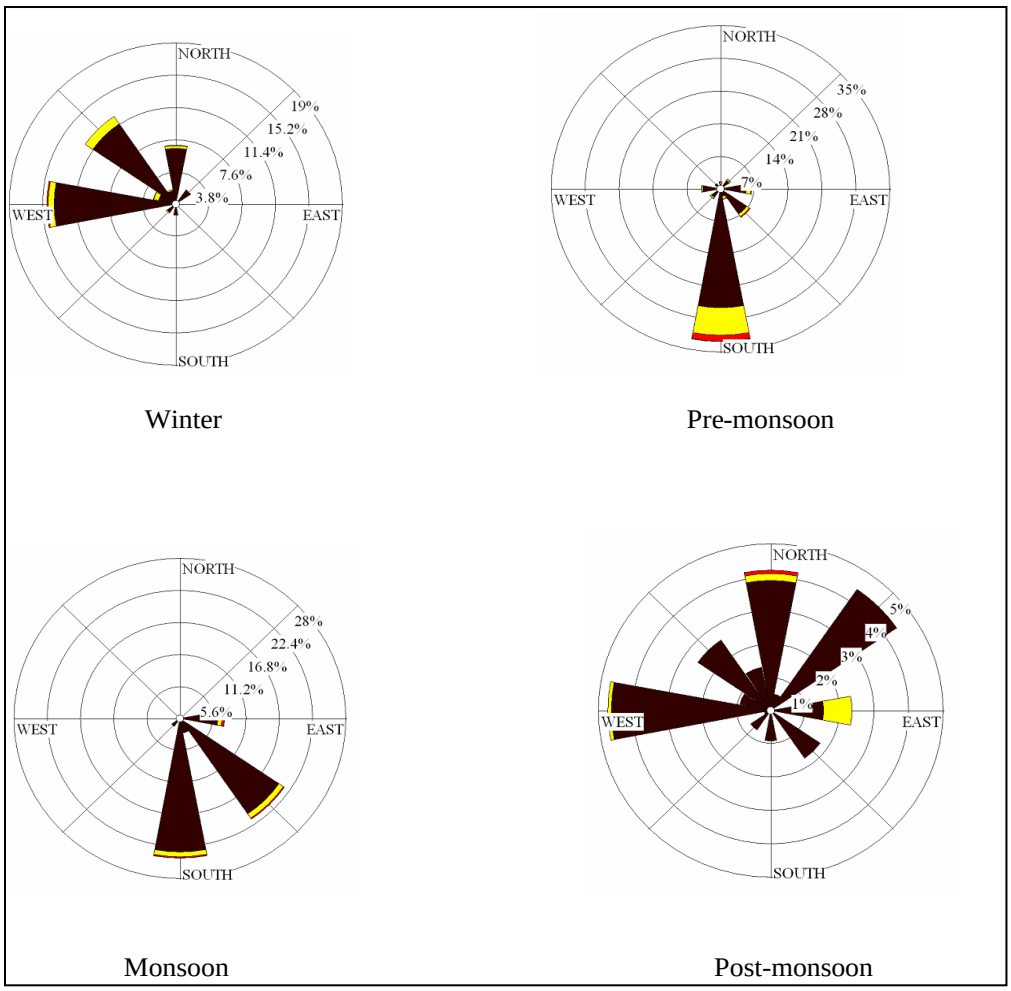


Figure 2: Seasonal wind direction pattern

2.1 PM SAMPLING

PM sampling was done using Air Metrics MiniVol sampler which was developed jointly by the U.S. Environmental Protection Agency (EPA) and the Lane Regional Air Pollution Authority. Although not listed in the reference sampler (FRM) list, it is very close to reference sampler in performance. For sampling with MiniVol sampler (Figure 3), the flow rate was maintained 5 liter per minute (lpm) at ambient conditions for proper size fractionation. The samplers were set up in the conventional manner with filters. Three samplers were placed at co-located position in the north site of the plant for 24h. Both fractions of PM samples were collected on Teflon (2.0 µm pore size) filters.

Figure 3: Air Metrics MiniVol sampler

PM Masses were measured in the Chemistry Division of the Atomic energy Centre, Dhaka (AECD) laboratory. The aerosol samples having PM were determined by weighing the filters before and after exposure using a micro balance (METTLER Model MT5) maintaining room temperature approximately at 22°C and relative humidity at 50%. The air filters were equilibrated at constant humidity and temperature of the balance room before every weighing. A U-shaped electrode charge eliminator (STATICMASTER) was used to eliminate the static charge accumulated on the filters before each weighing. The result is given in Table 1.

The ambient NO_2 sample was collected for 1 hour on impinger (Alkaline Sodium Arsenite) using Gent sampler and subsequent analysis was done using UV spectrometry. The ambient CO was monitored sequentially at plant site using GasBadge Pro monitor. Sampling campaigning was continued for 1 hour. 5 minutes average CO (ppm) was monitored every 15 minutes interval to obtain 1-hour average. The results are also presented in Table 1. The samplings were performed for 12 days. Altogether twelve SPM, twelve PM_{10} and twelve $PM_{2.5}$ samples were collected during this sampling campaigning.

Table 1: The ambient PM_{10}, $PM_{2.5}$, NO_2 and CO concentration during the sampling time

Sampling Date	SPM	PM_{10}	$PM_{2.5}$	NO_2	CO
	24h average (µg/m^3)			mg/m^3 (1h average)	
3/05/2015	249	153	55.8	0.081	4.85
3/08/2015	340	219	105	0.085	5.73
3/11/2015	609	369	129	0.076	3.44
3/14/2015	645	386	180	0.096	4.85
3/16/2015	450	254	186	0.086	4.85
3/19/2015	246	183	114	0.093	5.15
3/21/2015	524	317	196	0.072	4.01
3/23/2015	784	350	163	0.098	4.01
3/25/2015	507	258	126	0.075	3.44
3/27/2015	353	197	102	0.088	3.44

3/29/2015		317	246	129	0.066	2.86
3/31/2015		185	147	69.4	0.059	4.01
BNAAQS	**24h average**		**150**	**65**	**-**	**40 mg/m^3**
	Annual		**50**	**15**	**100**	**-**
WHO	**24h average**	**200-230**	**50**	**25**	**-**	**10,000**
	Annual		**20**	**10**	**40**	**-**

3. ANALYSIS OF AIR QUALITY DATA

It can be seen from Table 1 that the AQ primary standards (i.e., for the protection of public health) are specified both for yearly and shorter periods. The time available for measurements being short, direct determination of yearly average values is not feasible. So, these values have been determined using the assumption that the dispersion conditions for air pollutants are similar in Bangladesh except for the hilly areas. This is a reasonable assumption based on observation of weather parameters. Thus, the differences in AQ parameter values arise mainly due to local sources with dispersion conditions being the same. In order to derive the yearly values, the data from the Dhaka CAMS at Farmgate has been normalized to measured values for equivalent period to the measured values at the United Ashugajn Energy Ltd site. Using the same normalization, the values for other periods of the year have been found. The calculated yearly averages are **84±49 μg/m^3 and 233±124 μg/m^3 for $PM_{2.5}$ and PM_{10}** respectively which are higher than BNAAQS.

The results for this exercise for PM data are shown in Figure 4. It can be seen that the plant site belongs to a degraded air shed for PM as yearly NAAQ standards for both PM_{10} and $PM_{2.5}$ are exceeded. The measured daily values are also non-complaint with the daily NAAQS for much of the year. However, during wet season (May-September), the daily AAQ are within standards. The area is non-compliant for PM. The contribution of the plant is estimated. It has found that the contribution of this plant will be 13.9% compared to cumulative emissions of the other polluting industries in the area during operational phase.

Table 2 represents the ambient PM_{10}, $PM_{2.5}$, NO_2 and CO concentrations as per NAAQS as determined using extrapolation procedure. For NO_2 and CO very low values have been found in common with the observations at all the 11 CAMS in the country.

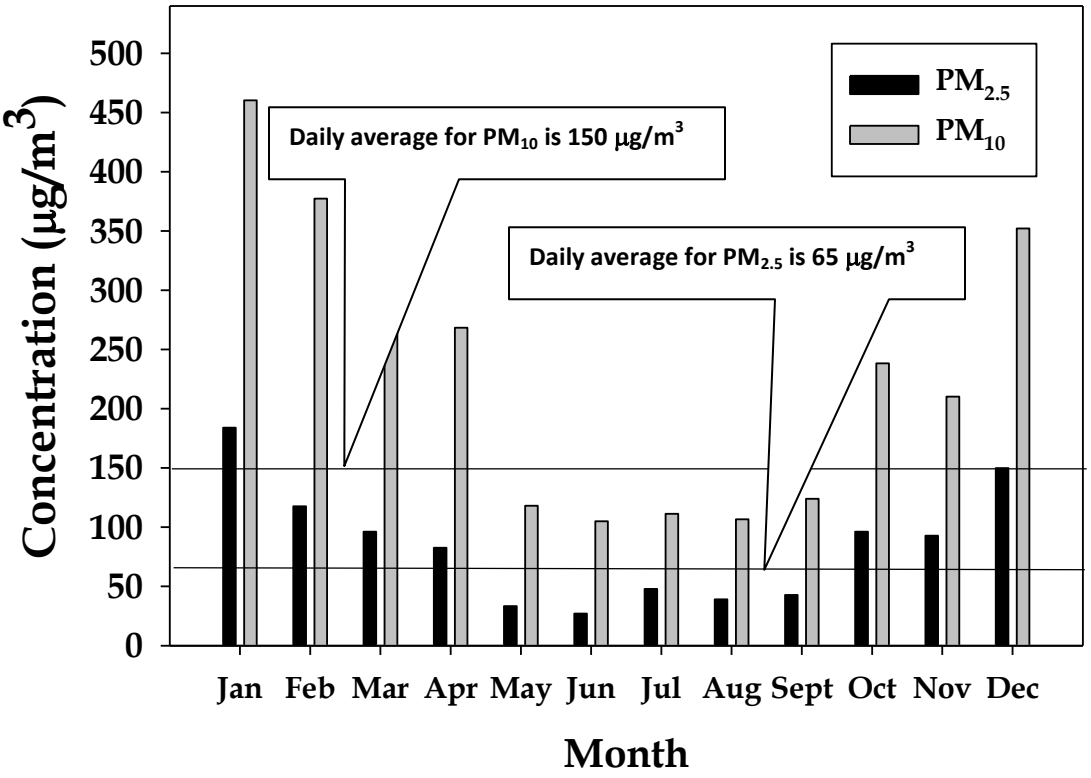


Figure 4: The yearly plot for ambient PM_{10}, $PM_{2.5}$ concentrations at the plant site using normalization procedure.

Table 2: The ambient PM_{10}, $PM_{2.5}$, NO_2 and CO concentrations as per NAAQS as determined using extrapolation procedure.

Pollutant	Averaging Time	Who Guidelines	Proposed Bangladesh Standards	Measured Concentration
CO	1 hour	30 mg/m^3	40 mg/m^3(35 ppm)	4.22±0.86 mg/m^3 (1 hour)
	8 hour	10 mg/m^3	10 mg/m^3 (9 ppm)	
SO_2*	24 hour	125 μg/m^3	365 μg/m^3 (140 ppb)	----
	Annual	50 μg/m^3	80 μg/m^3 (30 ppb)	-----
NO_2	1 hour	---	---	0.081±0.012 mg/m^3 (1 hour)
	Annual	40 μg/m^3	100 μg/m^3 (53 ppb)	
Ozone	1 hour	---	235 μg/m^3 (120 ppb)	
	8 hour	120 μg/m^3	157 μg/m^3 (80 ppb)	----
PM_{10}	24 hour	---	150 μg/m^3	257± 83 μg/m^3
	Annual	---	50 μg/m^3	233±124 μg/m^3
$PM_{2.5}$	24 hour	---	65 μg/m^3	130 ±45 μg/m^3
	Annual	---	15 μg/m^3	84± 49 μg/m^3

*Source: Not measured as there is no Sulfur in NG fuel used in the plant.

Annexure XI

Test Report SGS – Surface Water Quality

UNITED GROUP
HOUSE ##NW (J) 6, ROAD # 51, GULSHAN-2,
DHAKA-1212, BANGLADESH

THE FOLLOWING SAMPLE WAS SUBMITTED AND IDENTIFIED BY THE CUSTOMER AS:

SAMPLE DESCRIPTION	:	SURFACE WATER
SAMPLE CONDITION	:	WATER IN TWO CONTAINERS
RECEIVED SAMPLE QUANTITY	:	7 LITRE
SAMPLE RECEIVING DATE	:	20 APR 2015
TEST START DATE	:	20 APR 2015
TEST COMPLETION DATE	:	29 APR 2015

Sign for and on behalf of
SGS Bangladesh Ltd.

ENGINEER ISMAIL HOSSAIN
LABORATORY MANAGER

Reason: Amendment due to add heavy metal test result.
The test report no. DHK:FD: 1520000415 dated 27/04/2015 is cancelled and superseded by the Test report no. 1520000415 -1.

Test Results:

Test Items	Method	Result
Total Coliform	APHA 21ST Edition 2005 (9221B)	6.0 MPN/100 ml
Fecal Coliform	APHA 21ST Edition 2005 (9221E)	<2.0 MPN/100 ml
pH Value	APHA 22nd Edition 2012 (4500H^{+}B)	6.78 at 25℃ (LOD:2)
Conductivity	APHA 22ND Edition 2012 (2510 B)	142.3 µs/cm (LOD: 0.1 µs/cm)
Color	APHA 22nd Edition 2012 (2120 C)	20 Pt-Co (LOD:5.0 Pt-Co)
Turbidity	APHA 22nd Edition 2012 (2130 B)	12.55 NTU (LOD: 5 NTU)
Temperature Value	APHA 22nd Edition 2012 (2550 B)	23° C (LOD: 1℃)
Total Suspended Solid, (TSS)	APHA 22nd Edition 2012 (2540 D)	8.0 mg/l (LOD: 1.0 mg/l)
Total Dissolved Solid, (TDS)	APHA 22nd Edition 2012 (2540 C)	38.0 mg/l (LOD: 1 mg/l)
Dissolved Oxygen, DO	APHA 22nd Edition 2012 (4500-O G)	5.7 mg/l (LOD: 0.1 mg/l)
Biochemical Oxygen Demand, BOD	APHA 22nd Edition 2012 (5210 B)	ND (LOD: 1.0 mg/l)
Oil & Grease	APHA 22nd Edition 2012 (5520-B)	ND (LOD: 1.0 mg/l)
Chemical Oxygen Demand, COD	APHA 22nd 2012 (5220 B)	ND (LOD: 4.0 mg/l)
Chloride	APHA 22nd Edition 2012 (4500-Cl^{-} B)	3.97 mg/l (LOD: 0.5 mg/l)
Total Hardness (as$CaCO_3$)	APHA 22nd Edition 2012 (2340 C)	50.0 mg/l (LOD: 2.0 mg/l)
Total Alkalinity (as$CaCO_3$)	APHA 22nd Edition 2012 (2320 B)	50.0 mg/l (LOD: 10 mg/l)
Nitrate (NO3)	APHA 22nd Edition 2012, (4500-NO_3 B)	1.25 mg/l (LOD: 0.05 mg/l)
Sulphate	APHA 22nd Edition 2012, (4500-SO_4^{2-} E)	16.88 mg/l (LOD: 5.0 mg/l)
Total Phosphate	APHA 22nd Edition 2012 (4500-P B & E)	ND (DL: 0.46 mg/l)

Note: ND = Not Detected & LOD = Lower Detection Limit.

TEST ITEMS	METHOD	RESULT
Arsenic (as As)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Calcium (as Ca)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	12.06 ppm (LOD: 0.05 ppm)
Cadmium (as Cd)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Chromium (as Cr)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Copper (as Cu)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 mg/l)
Iron (as Fe)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	0.87 ppm (LOD: 0.05 ppm)
Mercury (as Hg)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Magnesium (as Mg)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	3.65 ppm (LOD: 0.05 ppm)
Manganese (as Mn)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Lead (as Pb)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)
Zinc (as Zn)	APHA 22nd EDITION 2012, Optical Emission Spectrometry by ICP-OES.	ND (LOD: 0.05 ppm)

Note: ND = Not Detected & LOD = Lower Detection Limit.

SAMPLE AS RECEIVED

✳✳✳ End of Report ✳✳✳

Annexure XII

Test Report BUET –Groundwater Quality

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC
Bureau of Research, Testing & Consultation

BRTC No. : **110085323/14- 15/CE; Dt: 5/5/2015** Ref. No. : Letter; Dt: 5/5/2015

Sent by : Mr. Rahat Bin Kamal, Assistant Manager, United Ashuganj Energy Ltd.

Project : United Ashuganj Energy Ltd. (UAEL) 195 MW Combined Cycle Modular Power Plant at Ashuganj

Company Address : United Centre House # NW(J)-6, Road # 51, Gulshan 2, Dhaka-1212 Source : Groundwater

Sample Id : ---- Location : United Ashuganj Energy Ltd. (UAEL), Ashuganj, Brahmanbaria

Date of Test : 7/5/2015 - 16/5/2015

TEST REPORT (ROUTINE DRINKING WATER PARAMETERS)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline Values 2004	Method of analysis	MDL
1	pH	-	**6.64**	6.5-8.5	6.5-8.5	USEPA 150.1; SM 4500-H+ B	0
2	Color	Pt-Co	**8**	15	15	USEPA 110.2; SM 2120 C	0.01
3	Turbidity	NTU	**1.1**	10	5	USEPA 180.1 Rev 2; SM 2130 B	0.01
4	Total Hardness as CaCO3	mg/L	**42**	200-500	200	USEPA 130.2; SM 2340 C	0.2
5	Chloride (Cl)	mg/L	**134**	150-600	250	USEPA 325.6; SM 4500-Cl-	1
6	Total Dissolved Solids (TDS)	mg/L	**344**	1000	1000	USEPA 160.2; SM 2540 B - D	5
7	Manganese (Mn)	mg/L	**0.094**	0.1	0.4a, 0.1b	USEPA 200.9 ; SM 3111 B	0.08
8	Arsenic (As)	mg/L	**0.006**	0.05	0.01	USEPA 206.2; SM 3113 B	0.001
9	Iron (Fe)	mg/L	**0.26**	0.3-1.0	0.3	USEPA 200.9 ; SM 3111 B	0.02
10	Total Coliform(TC)	CFU/100 ml	**28**	0	0	USEPA 9132; SM 9221 E	0
11	Fecal Coliform (FC)	CFU/100 ml	**16**	0	0	SM 9222 G	0

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Among the parameters tested , Total Coliform(TC), Fecal Coliform (FC) exceed(s) the acceptable limits set for Drinking Water in ECR 1997.

2. Sample was supplied by CLIENT
3. Sample was received in unsealed condition.

DEPARTMENT OF CIVIL ENGINEERING * BUET *

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Test Performed *by*:

Rowshan Mamtaz 16/5/15

Dr. Rowshan Mamtaz
Professor, Dept. of Civil Engineering

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/packet/container under signature of the competent authority. In order to avoid fraudulent fabrication of test results, it is recommended that all test reports are collected by duly authorized person, and not by the Contractor/Supplier.

Annexure XIII

Test Report SGS – Soil Quality

UNITED GROUP
HOUSE ##NW (J) 6, ROAD # 51, GULSHAN-2,
DHAKA-1212, BANGLADESH

THE FOLLOWING SAMPLE WAS SUBMITTED AND IDENTIFIED BY THE CUSTOMER AS:

SAMPLE DESCRIPTION	:	SOIL
SAMPLE CONDITION	:	SOIL IN ONE BAG
RECEIVED SAMPLE QUANTITY	:	5 KG
SAMPLE RECEIVING DATE	:	20 APR 2015
TEST START DATE	:	20 APR 2015
TEST COMPLETION DATE	:	27 APR 2015

Sign for and on behalf of
SGS Bangladesh Ltd.

ENGINEER ISMAIL HOSSAIN
LABORATORY MANAGER

Test Results:

Test Items	Method	Result
Lead (as Pb)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	8.70 mg/l (LOD: 5 mg/l)
Cadmium (as Cd)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	ND (LOD: 5 mg/l)
Chromium (as Cr)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	43.94 mg/l (LOD: 5 mg/l)
Copper (as Cu)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	71.31 mg/l (LOD: 5 mg/l)
Potassium (as)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	21621.0 mg/l (LOD: 5 mg/l)
Iron (as Fe)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	21008.0 mg/l (LOD: 5 mg/l)
Nickel (as Ni)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	21 mg/l (LOD: 5 mg/l)
Zinc (as Zn)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	71.0 mg/l (LOD: 5 mg/l)
Arsenic (as As)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	11.0 mg/l (LOD: 5 mg/l)
Mercury (as Hg)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	ND (LOD: 5 mg/l)
Barium (as Ba)	US EPA 3052 Optical Emission Spectrometry by ICP-OES.	19.0 mg/l (LOD: 5 mg/l)

Note: ND = Not Detected & LOD = Lower Detection Limit.

SAMPLE AS RECEIVED

✳✳✳ End of Report ✳✳✳

Annexure XIV

Sample Copy of Questionnaire

Used for Social Survey

INTERVIEW SCHEDULE: COMMUNITY

Name of Village and Mouza	
Number of Respondents (Male & Female)	
Date & time	

I. SOCIETAL SET UP

SN	Questions	Details/ Responses
	Average Family Size and number of bread earners in the family.	
	Occupations and Sources of Income for your family.	
	Average Monthly income in the family/ Families	
	Type of sanitation facilities (toilets) a. Outhouse/ pit latrine b. Sanitary Latrine with water	

II. PROJECT SPECIFIC

S. No.	QUESTIONS	DETAILS
1	Are you aware of the UAEL project in the area?	
3	What was the land used for before the coming of the project?	
4	Was any of the project land utilized by the people for grazing purposes/ community purposes?	
5	Has there been any change in your lives with the coming of the	

	project? How has the change affected you?	
6	Have land prices increased because of the project?	
7	Have employment opportunities gone up because of coming of Ashuhanj Hub?	
8	Has the traffic in the area increased?	
9	Are there any cultural heritage/ archaeological sites near the project area?	
9	Do you anticipate any negative risks associated with the project's operation?	
10	What Benefits do you see from the Project	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for a. Ashuganj hub b. UAEL	

III. FOR PROJECT AFFECTED FAMILIES (If any)

S. No.	QUESTIONS	DETAILS
	Impacted property: a. Land	

	b. Structure c. Source of Livelihood	
	If source of Livelihood, how?	
	What was the procuring procedure?	
	How was the compensation calculated?	
	Were the rates comparable with existing market rates?	
	Has the compensation been made in full?	
	How have you invested the compensation amount?	
	What was your average family income prior to impact and after?	

IV. GENDER RELATED QUESTIONS (To be asked to women specifically)

SN	Questions	Details/ Responses
1.	What are the literacy levels amongst girls? What are the reasons for discontinuing education?	
2.	Is there any special assistance provided to women through government schemes or Village councils?	
3.	Are there any NGOs working with the women. If Yes, on what issues, and how?	
4.	Any Self Help groups amongst women If Yes, then for what purpose?	
5.	In your opinion, how helpful have the government schemes and SHGs been to you?	
6.	Any vocational centres catering to women	

7.	Are Medical facilities available for women, such as for ANC check-ups during pregnancy, birthing, family planning and women specific health issues.	
8.	Are institutional births more common or home births? Why?	
9.	**What is the average** number of children per couple in current generation?	
10.	What kind of health problems are usually faced by women here?	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for c. Ashuganj hub d. UAEL	

V. NEEDS ASSESSMENT

(Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest)

S.N	Areas	Scale (1-10)	Remarks
1.	Education		
2.	Healthcare		
3.	Infrastructure (which) • Roads • Sanitation • Transportation • Electricity		
4.	Vocational Skill Development		
5.	Vocational Skill Development for women		
6.	Drinking Water		
7.	Agricultural Development		
8.	Other		

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

SN	Questions	Responses
1.	Name of Village/ Community	
2.	Mouza and Uppazila	
3.	Total population (Male & Female)	
4.	Ethnic/ Tribal Groups	
5.	Religions followed	
6.	Ongoing Government Schemes	
7.	Any NGOs working with the community. If so, then which area and since when.	

II. LIVELIHOOD PATTERNS

SN	Questions	Responses
1.	Main Occupations	
2.	Secondary occupations	
3.	Approximate Family Income (Monthly)	

4.	Do men Migrate outside the village for work?	
5.	Do Women Migrate Outside for Work?	
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	

III. ACCESS TO AMENITIES

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water			
2.	Water for Domestic Use			
3.	Water for Irrigation			
4.	Electricity for Domestic use			
5.	Electricity for farming and allied activities			

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools			
2.	Primary			
3.	Middle			
4.	Secondary			

5.	Senior Secondary			
6.	College			
7.	Technical Institutes			
8.	Vocational Training Centres			

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools			
2.	Hospital			
3.	Primary Health Centres			
4.	Pharmacies			
5.	Private Nursing Homes			
6.	Maternity Hospitals			
7.	Veterinary Hospitals			

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)			
2.	Road Condition			
3.	Post Office			
4.	Telecommunication			
5.	Banks			

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs b. In age group 20 – 40 yrs c. In age group 40 yrs and above	
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	
3.	Any Schools or Colleges only for Girls	
4.	Any vocational centres catering to women	
5.	Occupations amongst women	

NOTES

Annexure XV

Compensation Letter

Bangladesh Railway Estate Department

Bangladesh Railway
Estate Department

No: DEO/DHAKA/ASHUGANJ/WAPDA/8288/424 Date: 19-05-13

To: CEO/EAST/CHITTAGONG

Subject: **Allocation of Bangladesh Railway's land in favor of Ashuganj Power Station Company Ltd. (APSCL) for the construction of Power Plant inside Ashuganj Power Station complex to battle electricity crisis of the country**

Reference: Our due letter no. DEO/DHAKA/ASHUGANJ/WAPDA/8288/379 dated 29-04-2013

With reference to above subject and on examination of different records of this office this is to inform that there were 12 agriculture/fishery licensees on the 16.43 acres of land allocated by Bangladesh Railway in favor of Ashuganj Power Station Company Ltd. (ASPCL), out of the total licensee 9 licenses have already been expired and the following licenses are yet to expire.

1. Mr. Mahfuz Miah, Father- Late Al Haj Ashab Ali,
   Village- Araishidha, P.O.- Ashuganj,
   Thana- Ashuganj, District- Brahmanbaria — Taka: 43,200/-

2. Mr. Md. Shahab Miah, Father- Abdul Latif,
   Village- Shonarampur, P.O.- Ashuganj,
   Thana: B-Baria, District- Brahmanbaria — Taka: 36,749/-

3. Mr. Rafiqul Islam, Father- Late Aktaruzzaman — Taka: 2,83,018/-
   Village- Ashuganj, P.O.- Ashuganj,

Sd/General Manager

Annexure XVI

Filled in Survey Questionnaire and

List of participants

Haji Abdul Jalil High School.
Consultation held At.

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

SN	Questions	Responses
1.	Name of Village/ Community	Ashuganj Bazaar (Ashuganj)
2.	Mouza and Uppazila	8 unions in Uppazila Ashuganj Uppazila.
3.	Total population (Male & Female)	above 1 lakh (approx) 52 - 48 (female)
4.	Ethnic/ Tribal Groups	- none.
5.	Religions followed	approx 5000 hindus all muslim.
6.	Ongoing Government Schemes	Unaware. check with govt website. "Shobuj Chhatta" Family Planning.
7.	Any NGOs working with the community. If so, then which area and since when.	BRAC, ASA, Grameen Bank, Shoj, Proyash etc. → women's Rights. Approx - 6 - 8 years. all are - micro-financial agencies. none working for skill development.

II. LIVELIHOOD PATTERNS

SN	Questions	Responses
1.	Main Occupations	Business → traders, small fraction (less than 10%) → agriculture, daily wage labourers, fishermen, technicians
2.	Secondary occupations	power plant, fertilizer, GTCL (Manifold) Stn, technical skilled.
3.	Approximate Family Income (Monthly)	minimum 10K, average 15K rickshaw puller - 500 taka/day

4.	Do men Migrate outside the village for work?	ppl from outside come in for of jobs opportunities.
5.	Do Women Migrate Outside for Work?	women work in rice mills → come from outside local women → household activities.
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	no individual basis.

III. ACCESS TO AMENITIES

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water	Tubewell Borewell – 50 Ft. to 70 Ft.		"Good"
2.	Water for Domestic Use	~~Good~~ "		Reddish in colour High Iron content no drain
3.	Water for Irrigation	– "		
4.	Electricity for Domestic use	Good. Power cuts only during	20–24 hrs.	rainy season
5.	Electricity for farming and allied activities	– ". Same Source.		

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools	16 high schools including primary & college (Ashuganj Upazila)		
2.	Primary	✓ 01	All within	
3.	Middle (Private)	✓ 01	a 2km Radius.	
4.	Secondary	✓ 01.		

Govt. primary school, high school, 7 kindergarten → private.
govt. pays salary of staff.

5.	Senior Secondary	—		
6.	College	—		
7.	Technical Institutes	—		
8.	Vocational Training Centres	—		

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools	00	→ Dhaka university.	
2.	Hospital	3 medical centre / (non govt / private). hospital.	There is a nursing college nearby.	
3.	~~Primary Health Centres~~ medical centre for labour → govt + local pop[n]		Govt (Labour Welfare Centre)	
4.	Pharmacies	— community clinic	(Observation) Many Pharmacies around.	
5.	Private Nursing Homes	Not sure.		
6.	Maternity Hospitals	Not specific	Private Hospital	Day & Night Hospital
7.	Veterinary Hospitals	None	[hospital has 0 Ambulance & Emergency services.]	

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)	well connected excluding air.		
2.	Road Condition	good		
3.	Post Office	No.		
4.	Telecommunication	every one.		
5.	Banks	22 banks (govt. –	6, rest private)	all ATM facility

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs b. In age group 20 – 40 yrs c. In age group 40 yrs and above	average - dropout 10% - female's poverty (married off), family restrictions, women dropout decreasing, go outside to study ↳ college & universities
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	Not aware
3.	Any Schools or Colleges only for Girls	1 in the area. Ashuganj Upazila - 2
4.	Any vocational centres catering to women	Not aware
5.	Occupations amongst women	Household activities.

NOTES

INTERVIEW SCHEDULE: COMMUNITY

Name of Village and Mouza	Ashuganj Bazaar,
Number of Respondents (Male & Female)	Refer to Signatures.
Date & time	21/4/2015

I. SOCIETAL SET UP

SN	Questions	Details/ Responses
1.	Average Family Size and number of bread earners in the family.	4-8, All adults.
2.	Occupations and Sources of Income for ~~your family~~. the community.	Rice Mills, Ashuganj Hub. Ref to Baseline Form on Village Inventory.
3.	Average Monthly income in the family/ Families	n.
4.	Type of sanitation facilities (toilets) a. Outhouse/ pit latrine b. Sanitary Latrine with water	Most houses have sanitation facilities (80%).

II. PROJECT SPECIFIC

S. No.	QUESTIONS	DETAILS
1	Are you aware of the UAEL project in the area?	Yes.
3	What was the land used for before the coming of the project?	Water body, barren land, agriculture, Aquaculture in water body.
4	Was any of the project land utilized by the people for grazing purposes/ community purposes?	agriculture → not community purpose Husband was/his revenue land.
5	Has there been any change in your lives with the coming of the	Jobs have increased

no electricity problem, employment opportunities.

	project? How has the change affected you?	Employment, ↑ to business, Medical Facilities, Electricity.
6	Have land prices increased because of the project? ↑ In the last 6 years.	Yes } 30 - 40% But all land is Govt. owned — Railways.
7	Have employment opportunities gone up because of coming of Ashuhanj Hub?	very high ; increased
8	Has the traffic in the area increased?	Not really.
9	Are there any cultural heritage/ archaeological sites near the project area?	Mosque in the area ; estbd in 135(100 years ← (bengali year)
9	Do you anticipate any negative risks associated with the project's operation?	Sound pollution ; → sound from power plant,
10	What Benefits do you see from the Project	employment opportunities
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for a. Ashuganj hub b. UAEL	No.

III. FOR PROJECT AFFECTED FAMILIES (If any) N.A.

S. No.	QUESTIONS	DETAILS
1	Impacted property: a. Land b. Structure c. Source of Livelihood	

2	If source of Livelihood, how?	
3	What was the procuring procedure?	
4	How was the compensation calculated?	
5	Were the rates comparable with existing market rates?	
6	Has the compensation been made in full?	
7	How have you invested the compensation amount?	
8	What was your average family income prior to impact and after?	

N.A

IV. GENDER RELATED QUESTIONS (To be asked to women specifically)

SN	Questions	Details/ Responses
1.	What are the literacy levels amongst girls? What are the reasons for discontinuing education?	
2.	Is there any special assistance provided to women through government schemes or Village councils?	
3.	Are there any NGOs working with the women. If Yes, on what issues, and how?	
4.	Any Self Help groups amongst women If Yes, then for what purpose?	
5.	In your opinion, how helpful have the government schemes and SHGs been to you?	
6.	Any vocational centres catering to women	

7.	Are Medical facilities available for women, such as for ANC check-ups during pregnancy, birthing, family planning and women specific health issues.	
8.	Are institutional births more common or home births? Why?	
9.	**What is the average** number of children per couple in current generation?	
10.	What kind of health problems are usually faced by women here?	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for c. Ashuganj hub d. UAEL	

V. NEEDS ASSESSMENT

(Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest)

S.N	Areas	Scale (1-10)	Remarks
1.	Education	— 0 —	
2.	Healthcare	10	hospital
3.	Infrastructure (which) a. Roads b. Sanitation c. Transportation d. Electricity	— 0 —	
4.	Vocational Skill Development	—	0 —
5.	Vocational Skill Development for women	8	centres for women
6.	Drinking Water	— 0	—
7.	Agricultural Development	—	0 —
8.	Other	10 Transport	system

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

/Govt Primary School/

SN	Questions	Responses
1.	Name of Village/ Community	Sonarampur.
2.	Mouza and Uppazila	N/·
3.	Total population (Male & Female)	Unsure.
4.	Ethnic/ Tribal Groups	All Muslims, No Tribal Groups
5.	Religions followed	Islam.
6.	Ongoing Government Schemes	Not Sure. "Check with Union Head"
7.	Any NGOs working with the community. If so, then which area and since when.	Asha, BRAC, → In Ashuganj Bazaar.

II. LIVELIHOOD PATTERNS

SN	Questions	Responses (In order of Preference)
1.	Main Occupations	(2) Business, (1) Rice mills (3) Agriculture → Paddy, Mustard.
2.	Secondary occupations	→ Service at Power plant → Cycle Rickshaw → Car, Taxi, boats etc.
3.	Approximate Family Income (Monthly)	(1) Rice mills: ~~2000~~ 100-150 per day (2) Agriculture: (15 to 2000 + Food. If you have some land) (3) Transportation: 20,000 –

→ Some youth migrate to the middle East for work

4.	Do men Migrate outside the village for work?	Yes, But only for selling produce.
5.	Do Women Migrate Outside for Work?	" / Men stay for days women don't permanent migration.
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	No Cooperatives except for the Microfinance institutions.

III. ACCESS TO AMENITIES

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water	Tube Wells	all day.	[Reddish] But happy villagers.
2.	Water for Domestic Use	" For washing clothes – River.		"
3.	Water for Irrigation	NA	NA	NA
4.	Electricity for Domestic use	all Day.		
5.	Electricity for farming and allied activities	— N. A	—	

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools Drop and Rate	50% to 60%. – mostly girls		
2.	Primary → 583 students.	01	within village.	→ 5 teachers
3.	Middle + Secondary.	02.	(1) Shohagpur (2) Ashuganj Rozamas.	
4.	Secondary		all Schools	co. ed.

5.	~~Senior Secondary~~ Junior College		B. Baria	Sufficient
6.	College	Dhaka		Good
7.	Technical Institutes		B. Baria	
8.	Vocational Training Centres		None	

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools			
2.	Hospital			
3.	Primary Health Centres			
4.	Pharmacies			
5.	Private Nursing Homes			
6.	Maternity Hospitals			
7.	Veterinary Hospitals			

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)			
2.	Road Condition			
3.	Post Office			
4.	Telecommunication			
5.	Banks			

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs b. In age group 20 – 40 yrs c. In age group 40 yrs and above	"Some even college". 5th Std - 8th. Illiterate mostly 10 th
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	None. Banks (Microfinance agencies)
3.	Any Schools or Colleges only for Girls	No.
4.	Any vocational centres catering to women	No -
5.	Occupations amongst women	House Management. & supporting husbands business

Rice Mill workers working near School. ← Rice mill workers:

Tine hand to mouth existance.

No idea of benefits or impacts.

NOTES

Interview with (Stall owner)

6 No negative points. - Increase in business - Purchasing power - Laundry business - Electricity - "My land was barren". now I am using it ... ... For economic productivity Observations: - No lighting in huts - Inadequate toilets - All kids born at home - Initially Migrants - Man get 150 taka/day Woman - 100/- - kids go to govt school but not regularly. - "Cannot afford Dayaga Hospital" * Check for images * Check if Rice Mill workers fall within the category of Floating population.

Note: Guy was poor till the land project came up - Land "Barren" Now Busy business.

INTERVIEW SCHEDULE: COMMUNITY

Name of Village and Mouza	Sonasampur.
Number of Respondents (Male & Female)	Ayesha Begum. Principal. (AYESHA BEGUM + 4 teachers.)
Date & time	Ashuganj Govt Primary School. East

I. SOCIETAL SET UP

SN	Questions	Details/ Responses
1.	Average Family Size and number of bread earners in the family.	There are families who have decided to have just 1 kid & there are those with 8-9 kids.
2.	Occupations and Sources of Income for your family. Community. Teaching, Agro, Fish, Skilled & Unskilled Labour	
3.	Average Monthly income in the family/ Families Can't say.	Women mostly manage the home.
4.	Type of sanitation facilities (toilets)	
	a. Outhouse/ pit latrine most are pit latrines	70%. have Latrines
	b. Sanitary Latrine with water	30%. prefer Open.

* Noticed kids playing every where in the open.

II. PROJECT SPECIFIC

S. No.	QUESTIONS	DETAILS
1	Are you aware of the UAEL project in the area?	Yes.
3	What was the land used for before the coming of the project? From all Respondents [There were different Responses.]	1 Barren - 2 Can't Remember, 3 Fenced, 4 Com grazing.
4	Was any of the project land utilized by the people for grazing purposes/ community purposes?	Yes. ~~No~~ — Fenced Area — Small area for grazing since Comm can't get in. - Goats
5	Has there been any change in your lives with the coming of the	

	project? How has the change affected you?	1 → more hotels + shops. 2 → More employment 3 → Land value increased
6	Have land prices increased because of the project?	yes, and that is good.
7	Have employment opportunities gone up because of coming of Ashuhanj Hub?	Yes, both semi skilled & unskilled. Only men.
8	Has the traffic in the area increased?	Communication due to connectivity. not commuting Traffic has increased as well & that's good.
9	Are there any cultural heritage/ archaeological sites near the project area?	None.
9	Do you anticipate any negative risks associated with the project's operation?	→ Too much Traffic → Sound pollution due to the blow off steam. → Chemical smell. (From the Fertilizer Factory)
10	What Benefits do you see from the Project	Benefits Expected Earlier.
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for a. Ashuganj hub b. UAEL	"No need." For both

III. FOR PROJECT AFFECTED FAMILIES (If any) — N.A -

S. No.	QUESTIONS	DETAILS
1	Impacted property: a. Land b. Structure c. Source of Livelihood	

2	If source of Livelihood, how?	
3	What was the procuring procedure?	
4	How was the compensation calculated?	
5	Were the rates comparable with existing market rates?	N.A
6	Has the compensation been made in full?	
7	How have you invested the compensation amount?	
8	What was your average family income prior to impact and after?	

IV. GENDER RELATED QUESTIONS (To be asked to women specifically)

→ * check if the microfinance institutions give loans is bound to women. In matters other than finance.

SN	Questions	Details/ Responses
1.	What are the literacy levels amongst girls? What are the reasons for discontinuing education? — Marriage - early marriage	< 70% go out of Sararaipur for college — to Bhairab, Dhaka, marriage + kids + resp. ↳ most study continued. Boys → 80%. ↳ commerce & science
2.	Is there any special assistance provided to women through government schemes or Village councils? — None.	1 → Special scholarship. 2 → All education fees for both girls & boys
3.	Are there any NGOs working with the women. If Yes, on what issues, and how? Primary & secondary level.	
4.	Any Self Help groups amongst women If Yes, then for what purpose? + BRAC.	1 → micro loans — → Grameen Bank & Asha. → loans, small business.
5.	In your opinion, how helpful have the government schemes and SHGs been to you?	Loans for: Not very helpful since the skill is not developed.
6.	Any vocational centres catering to women	None / one Stitching centre in Ashuganj Bazaar.

"Shobhuj" not Shobhut. – Comes Visits Twice/once a week.

7.	Are Medical facilities available for women, such as for ANC check-ups during pregnancy, birthing, family planning and women specific health issues.	Ashuganj bazaar – both community & private → Comes monthly.
8.	Are institutional births more common or home births? Shobut chhata (Green Umbrella) worker. Why?	Shobut Chhata – Family Planning Worker → Green Umbrella.
9.	What is the average number of children per couple in current generation? Residence births preferred mostly.	Residence ~~Bxxx~~ Preferred mostly.
10.	What kind of health problems are usually faced by women here?	→ Fever → complications – during birth.
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for c. Ashuganj hub d. UAEL	None. whatsoever.

V. **NEEDS ASSESSMENT**

(Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest)

S.N	Areas	Scale (1-10)	Remarks
1.	Education	~~10~~	→ ~~Adult Education esp women~~
2.	Healthcare	9.	
3.	Infrastructure (which) a. Roads b. Sanitation c. Transportation d. Electricity	→ Landscape – 10. → 80% have toilets – Remaining don't want to use toilets	
4.	Vocational Skill Development	— 0	
5.	Vocational Skill Development for women	10	→ Adult Education For women.
6.	Drinking Water From tube well	— 0 —	
7.	Agricultural Development	— 0 —	
8.	Other ~~Develop~~ ~~Development~~	No Response.	

No Arsenic.

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

SN	Questions	Responses
1.	Name of Village/ Community	Sohagpur.
2.	Mouza and Uppazila	
3.	Total population (Male & Female)	9000
4.	Ethnic/ Tribal Groups	No.
5.	Religions followed	Muslim
6.	Ongoing Government Schemes	Free Education & Scholarship for female.
7.	Any NGOs working with the community. If so, then which area and since when.	Grameen, BRAC, Pangeri micro-finance, ~~Green~~ Bangla Bond

II. LIVELIHOOD PATTERNS

SN	Questions	Responses
1.	Main Occupations	Agriculture - 40% Business - 60% - Rice Mills, Fuel
2.	Secondary occupations	Daily Wage Labourers Technical (Power Plants) + unskilled
3.	Approximate Family Income (Monthly)	Labourer -> 8K - 10K/mth Agriculture -> seasonal (no profit) Business -> 20K - 25K/mth

4.	Do men Migrate outside the village for work?	Yes, Dhaka; all over out of B'desh – labourer, technician etc.
5.	Do Women Migrate Outside for Work?	mainly – housewives – 95% working – 5%; no, they don't go out; teacher, poultry farm, labourer
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	2 co-operatives; ↳ micro-finance – one house, one for poultry; mostly individuals

III. ACCESS TO AMENITIES

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water	Tubewell – Deep	→ Arsenic free; iron content	
2.	Water for Domestic Use	Yes		
3.	Water for Irrigation	Drainage facility available; APSCL, outlet water is used for agriculture purpose		
4.	Electricity for Domestic use	Yes – 100%		
5.	Electricity for farming and allied activities	No		

1:65 teacher student ratio

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools	K·G·5		
2.	Primary	2 (Govt)		
3.	Middle			
4.	Secondary (High)	1 (Semi Govt)		

Drop-out rate → 70/800 (varies yearly) → girls & boys

more dropouts

marriage, ~~domestic~~ poverty

5.	Senior Secondary			
6.	College	1 (Private)		
7.	Technical Institutes	—		
8.	Vocational Training Centres	—		

10% go to Dhaka; most around the area.

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools			
2.	Hospital			
3.	Primary Health Centres (Community Centre)	1 (Govt) → Health workers (govt) visit the village (3)		Brahmanbaria Hospital – Ashuganj ↓ maternity
4.	Pharmacies			
5.	Private Nursing Homes			
6.	Maternity Hospitals	—		
7.	Veterinary Hospitals	—	Ashuganj → but comes here.	

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)	CNG (most auto Rickshaw, Motorbike)	→ Bus →	Highway
2.	Road Condition	paved		
3.	Post Office	—		
4.	Telecommunication	mobile phones		
5.	Banks	—	Ashuganj Bazar	(22) banks.

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs → literate b. In age group 20 – 40 yrs c. In age group 40 yrs and above	60+ % (approx)
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	through NGO.
3.	Any Schools or Colleges only for Girls	No.
4.	Any vocational centres catering to women	No.
5.	Occupations amongst women	—.

NOTES

INTERVIEW SCHEDULE: COMMUNITY

Name of Village and Mouza	~~Sahagpur~~ Sahagpur.
Number of Respondents (Male & Female)	
Date & time	

I. SOCIETAL SET UP

SN	Questions	Details/ Responses
1.	Average Family Size and number of bread earners in the family.	4 to 8. As many men.
2.	Occupations and Sources of Income for your family.	
3.	Average Monthly income in the family/ Families	
4.	Type of sanitation facilities (toilets) a. Outhouse/ pit latrine b. Sanitary Latrine with water	95% have 5% do not have.

II. PROJECT SPECIFIC

S. No.	QUESTIONS	DETAILS
1	Are you aware of the UAEL project in the area?	Yes
3	What was the land used for before the coming of the project?	Barren & sometime agriculture.
4	Was any of the project land utilized by the people for grazing purposes/ community purposes?	
5	Has there been any change in your lives with the coming of the	Yes; lifestyle change → electricity; business has expanded; marking, rented accn has come up; shops have come up.

	project? How has the change affected you?	
6	Have land prices increased because of the project?	Near the power stn, it has gone up.
7	Have employment opportunities gone up because of coming of Ashuhanj Hub?	Yes.
8	Has the traffic in the area increased?	yes.
9	Are there any cultural heritage/ archaeological sites near the project area?	No.
9	Do you anticipate any negative risks associated with the project's operation?	No.
10	What Benefits do you see from the Project	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for a. Ashuganj hub b. UAEL	No.

III. FOR PROJECT AFFECTED FAMILIES (If any)

S. No.	QUESTIONS	DETAILS
1	Impacted property: a. Land b. Structure c. Source of Livelihood	

2	If source of Livelihood, how?	
3	What was the procuring procedure?	
4	How was the compensation calculated?	
5	Were the rates comparable with existing market rates?	
6	Has the compensation been made in full?	
7	How have you invested the compensation amount?	
8	What was your average family income prior to impact and after?	

IV. GENDER RELATED QUESTIONS (To be asked to women specifically)

SN	Questions	Details/ Responses
1.	What are the literacy levels amongst girls? What are the reasons for discontinuing education?	
2.	Is there any special assistance provided to women through government schemes or Village councils?	
3.	Are there any NGOs working with the women. If Yes, on what issues, and how?	
4.	Any Self Help groups amongst women If Yes, then for what purpose?	
5.	In your opinion, how helpful have the government schemes and SHGs been to you?	
6.	Any vocational centres catering to women	

7.	Are Medical facilities available for women, such as for ANC check-ups during pregnancy, birthing, family planning and women specific health issues.	
8.	Are institutional births more common or home births? Why?	
9.	**What is the average** number of children per couple in current generation?	
10.	What kind of health problems are usually faced by women here?	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for c. Ashuganj hub d. UAEL	

V. NEEDS ASSESSMENT

(Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest)

S.N	Areas	Scale (1-10)	Remarks
1.	Education	Girls school & college (10)	
2.	Healthcare	Hospital (10)	
3.	Infrastructure (which) a. Roads b. Sanitation c. Transportation d. Electricity	improvement (10)	
4.	Vocational Skill Development	—	0
5.	Vocational Skill Development for women	Yes (10)	
6.	Drinking Water	0	
7.	Agricultural Development	0	
8.	Other	0	

UAEL

AECOM

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

SN	Questions	Responses
1.	Name of Village/ Community	char Songrampur (the small island)
2.	Mouza and Uppazila	Ashuganj Union + Upazila.
3.	Total population (Male & Female)	500 Families
4.	~~Ethnic/ Tribal Groups~~ No. of kids / family	→ 4 to 5 per family. → 2-3 share one.
5.	Religions followed Mostly Hindus (Das)	20-25 families Muslims Rest Hindus
6.	Ongoing Government Schemes	Micro Finance - For net, housing etc.
7.	Any NGOs working with the community. If so, then which area and since when.	Asha, BRAC; Grameen. Shomobay → Small interest based Micro Finance

Impact - * The Fish catch has reduced due to the thermal power plant but because of the fertilizer Plant dumping debris into the river.

II. LIVELIHOOD PATTERNS

SN	Questions	Responses
1.	Main Occupations	Fishing - Prawns, Incha Mach, Kachi Mach, Kuti Mach? Both ways of fishing - Net + Boat + trap.
2.	Secondary occupations	Wooden Furnishers Rice Mills. Fishing - 80%. Dailywage - 10% Carpentry - 10%.
3.	Approximate Family Income (Monthly)	Daily - 200-300 ~~Rs~~ Taka. Otherwise hardly - mostly consumed by self.

Furniture Making - 500 - 600 Taka / day.

4.	Do men Migrate outside the village for work?	Dakha → For Fish Selling. & Daily magl.
5.	Do Women Migrate Outside for Work?	~~No~~: Nearby Places for Daily magl. But not out of village
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	→ Males earn - 350 - 400/- Females - 300/Taka / day → None.

III. ACCESS TO AMENITIES

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water	Tubewell.	High Iron content.	Red Water
2.	Water for Domestic Use	Tube well.		
3.	Water for Irrigation	Tube well		
4.	Electricity for Domestic use	None at all.		No Amenities
5.	Electricity for farming and allied activities	No. of Electricity.		

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools			
2.	Primary	01	Within Village.	
3.	Middle	None	Ashuganj	By boat
4.	Secondary	None.	Ashuganj.	By boat

5.	Senior Secondary			
6.	College	Ashuganj & → Not Beyond		
7.	Technical Institutes	10 - 15% Ashuganj → Not Beyond.		
8.	Vocational Training Centres	Gr - Boys	M & F	"

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools	→ Ashuganj & Bhairab.		
2.	Hospital	0! [Gone] within Village.		Few needs.
3.	Primary Health Centres	→ Vaccine + Health Check ups		
4.	Pharmacies None	→ Not many, Home Deliveries Mostly Pesticides & Cosmetics		
5.	~~Private Nursing Homes~~	① Weekly visits for pregnant women.		
6.	Maternity Hospitals	② Pharmacist → First Aid None → Health care workers.		
7.	~~Veterinary Hospitals~~	Common ailments:		

Typhoid, diarrhoea, Fever, Vomit — Problem??

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)	③ MBBS Doc comes 2-3 a week.		
2.	Road Condition	④ ~~Hi~~ weekly immunization		
3.	Post Office	@ Bhairab & Ashuganj	1 Km.	
4.	Telecommunication	—	None.	
5.	Banks	Bhairab & Ashuganj.		

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs b. In age group 20 – 40 yrs c. In age group 40 yrs and above	~~6th 7th~~ 5th std. Only 10% of population educated – of these even 10% goes to high school.
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	None
3.	Any Schools or Colleges only for Girls	None
4.	Any vocational centres catering to women	None
5.	Occupations amongst women	– House Hold work.

NOTES

(* Observation: Very thin kids – women small & under developed.)

Primary School: – Not sufficient Tables & benches
– School gets flooded during monsoons.

During Flooding: the villagers prefer not leaving the place and hang hammocks

Loan Sharks are preferred to avoid paper hassles for & NGO's.

→ 200 – 300 have currently taken loan from Loan Sharks.

To alleviate Poverty:

① Break the cycle of Indebtness.
↳ Avoid investment with least capital investment.

② Loan Sharks.

③ Improve the std. of living.

VILLAGE/ WARD INVENTORY

I. GENERAL PROFILE VILLAGE/ COMMUNITY

SN	Questions	Responses
1.	Name of Village/ Community	Paltakanda. Fishing wholesale market → All fishing community lives here.
2.	Mouza and Uppazila Paltakanda & Bhairab.	
3.	Total population (Male & Female)	"Not Sure."
4.	Ethnic/ Tribal Groups	None.
5.	Religions followed	Islam
6.	Ongoing Government Schemes	"Not Sure"
7.	~~Any NGOs working with the community. If so, then which area and since when.~~ 8. You also trade veggies here. where do you grow them?	A: veggies come from Barichai. the trading is done here. ~~Fish Rates~~: No veggies grown on a commercial basis.

Fish Rates: Pangash 120 TK/kg. Rui fish – 300 TK/kg. Carp Fish 180 TK/kg. Silver – 60 TK/kg.

II. LIVELIHOOD PATTERNS

SN	Questions	Responses
1.	Main Occupations biggest fish selling market	Service → Hotel, Grocery Store. Fishermen → catch & sell (maximum)
2.	Secondary occupations	Daily wage labourer, tailor. ~~[illegible]~~ handle the waste oil from thermal plant and sell to other vendors. sell coal
3.	Approximate Family Income (Monthly)	30,000 – 35,000 /mth – fishermen 20K – 25K / – others

active NGOs → BRAC, ASA, Grameen, B

4.	Do men Migrate outside the village for work?	men migrate to other areas – business sell fish
5.	Do Women Migrate Outside for Work?	No
6.	Any cooperative societies in the village? Eg. Milk, Poultry, weaving.	~~Yes~~ ; Dairy Farm, – Local

III. ACCESS TO AMENITIES

Agriculture – very little, → vegetable, rice → 5%.

SN	Types Of Facility	Source	Duration of Supply	Remarks
1.	Drinking Water	Tubewell		Iron content – 95%; no arsenic
2.	Water for Domestic Use	(do)		Bathing & pooping – River. – Clothes washing River too
3.	Water for Irrigation	River		
4.	Electricity for Domestic use	Yes → power cut		
5.	**Electricity for farming and allied activities**	– N. A – Same.		

SN	Education	No. of Facilities	Location and Distance from Village	Remarks
1.	Schools			
2.	Primary	1 (Govt)	within village	
3.	Middle			
4.	Secondary (High)	1 (Private)	within Village.	

Bahirab

5.	Senior Secondary		Ashuganj (Union College)	
6.	College		1 km	
7.	Technical Institutes	—		
8.	Vocational Training Centres	—		

Girls go for Masters as well. Women don't go for work.

SN	Health Facilities	No. of Facilities	Location and Distance from Village	Remarks
1.	Medical Schools			
2.	Hospital	1 (Govt) # 4 (Private)		Good
3.	Primary Health Centres	01		
4.	Pharmacies	(Observation)	- Plenty in the market	(all private)
5.	Private Nursing Homes	12 (clinics,	nursing home	etc.) — B.B.
6.	Maternity Hospitals	— Nothing	Specific -	1 km radius
7.	Veterinary Hospitals	2		

Purbadha Bairab Salsha

SN	Other Amenities	No. of Facilities	Location & Distance from Village	Remarks
1.	Transport Facilities (rail connectivity, bus services)		Tricycle, CNG, Auto	
2.	Road Condition			"Good"
3.	Post Office		Bairab	
4.	Telecommunication		cell phones — each	Family has
5.	Banks		Bairab Bazar	

IV. GENDER RELATED QUESTIONS

SN	Questions	Details/ Responses
1.	literacy levels Amongst women: a. In age group 15 – 20 yrs b. In age group 20 – 40 yrs c. In age group 40 yrs and above	"All are educated". → "Yes, even them".
2.	Any Women specific special provisions: a. Through government Schemes b. Through village council c. NGOs	
3.	Any Schools or Colleges only for Girls	} None.
4.	Any vocational centres catering to women	
5.	Occupations amongst women	Home makers & managing cattle.

NOTES

Benefits → not really; mostly businessman, ~~not~~ affect on business

Issues / Concerns → No problems → However, rates have increased for the local produce too

Sanitary facilities → good, they get it free from Purashabha

Average family size → 3 to 4.

↳ Making veggies & grains incl. rice more expensive [~~Inflation~~]? No. Not Inflation

Prawn, Aar, Rohu, Katla, Boal, etc.
↳ types of fish caught & "cultured".

* Observation: Kids have smaller stomachs..

Black - Rice Mill owners
Blue - Doctors - Nephrologist @ Day & Night Hospital

AECOM

INTERVIEW SCHEDULE: COMMUNITY

Name of Village and Mouza	char Chantola
Number of Respondents (Male & Female)	Doctors @ Day & Night Hospital + Rice Mill owners
Date & time	

I. SOCIETAL SET UP

SN	Questions	Details/ Responses
1.	Average Family Size and number of bread earners in the family.	At least 4 - kids
2.	Occupations and Sources of Income for your family.	— N.A —
3.	Average Monthly income in the family/ Families	Don't know. Rice workers → the poorest
4.	Type of sanitation facilities (toilets) a. Outhouse/ pit latrine b. Sanitary Latrine with water	90 % have toilets mainly open defecation.

Sanitation needs attention

II. PROJECT SPECIFIC

S. No.	QUESTIONS	DETAILS
1	Are you aware of the UAEL project in the area?	Yes. (Doctors grew up here).
3	What was the land used for before the coming of the project?	Barren. ← Defecation. ← For playing cricket by kids.
4	Was any of the project land utilized by the people for grazing purposes/ community purposes?	Cow Dung — no agro for sure.
5	Has there been any change in your lives with the coming of the	More people, poor sanitation — more also more bone infections

	project? How has the change affected you?	Our business has improved since transportation facilities have improved.
6	Have land prices increased because of the project?	Yes.
7	Have employment opportunities gone up because of coming of Ashuhanj Hub?	Yes Bamboo business has gone up because of the hub → Roads & Railways + Riverine port.
8	Has the traffic in the area increased?	Yes. Heavy
9	Are there any cultural heritage/ archaeological sites near the project area?	No.
9	Do you anticipate any negative risks associated with the project's operation?	① - More thorough inspections & UT issued due to poor sanitation Contagious diseases Due to influx of outsiders
10	What Benefits do you see from the Project	Business ↑ But not every one would benefited - (How?) more purchasing power - hence + nutrition
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for a. Ashuganj hub b. UAEL	No No.

III. FOR PROJECT AFFECTED FAMILIES (If any)

S. No.	QUESTIONS	DETAILS
1	Impacted property: a. Land b. Structure c. Source of Livelihood	

2	If source of Livelihood, how?	
3	What was the procuring procedure?	
4	How was the compensation calculated?	
5	Were the rates comparable with existing market rates?	
6	Has the compensation been made in full?	
7	How have you invested the compensation amount?	
8	What was your average family income prior to impact and after?	

IV. GENDER RELATED QUESTIONS (To be asked to women specifically) Doctor Responded

SN	Questions	Details/ Responses
1.	What are the literacy levels amongst girls? What are the reasons for discontinuing education?	Established → 20-25 age group. → Marriage | Younger lot Continuing Education.
2.	Is there any special assistance provided to women through government schemes or Village councils?	No Idea
3.	Are there any NGOs working with the women. If Yes, on what issues, and how?	– No. Idea.
4.	Any Self Help groups amongst women If Yes, then for what purpose?	– Microfinance.
5.	In your opinion, how helpful have the government schemes and SHGs been to you?	– No. Idea.
6.	Any vocational centres catering to women	– No.

7.	Are Medical facilities available for women, such as for ANC check-ups during pregnancy, birthing, family planning and women specific health issues.	
8.	Are institutional births more common or home births? Why?	
9.	What is the average number of children per couple in current generation?	
10.	What kind of health problems are usually faced by women here?	
11.	Have you ever faced any safety, security issues or inconvenience due to outsiders working for c. Ashuganj hub d. UAEL	

V. NEEDS ASSESSMENT

(Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest)

S.N	Areas	Scale (1-10)	Remarks
1.	Education		
2.	Healthcare		
3.	Infrastructure (which) a. Roads b. Sanitation c. Transportation d. Electricity		
4.	Vocational Skill Development		
5.	Vocational Skill Development for women		
6.	Drinking Water		
7.	Agricultural Development		
8.	Other		

MEETING LOCATION:	DATE:
Primary School - Sonarampur.	21/04/2015.

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
১।	[illegible] বেগম	৪৮ [illegible]	[illegible] F
২।	নিজার সুলতানা	মোনারামপুর	নিজার F
৩।	Tanjia Afrin	kalabagan	Tanjia F
৪।	Md. Sohrab Hossain	Asuganj Bazar	Sohrab M
৫।	রাবিয়া বেগম	৮ বছাইর, আশুগঞ্জ	রাবিয়া F
	Daily wage Migrant workers near School.		
6	Salim Mia, Mhd.	Bortala.	
7	Md. Abul Hossain.	Bortala. "	
8	Md. Salim Sardar	Barisal.	
9	Rohima Begum.	Barisal.	রহিমা
	Shopkeeper near Plant.		
10	Fazilat Khan.	Sonarampur.	MD FAZILAT KHAN
11.	Store keeper from Ashuganj Upazilla Health Centre	Char Chartala	
12	KAZI ABU ALL RASEL	B. Basti a Sadar	
13.	Dr. Md. Suman Sarker. MBBS. & FCPS - Part-I MD (Nephrology). Part-2.	Day night hospital	21.04.15. (Charchartala, Ashuganj)

MEETING LOCATION:	DATE:
Char Lonarampur.	22/04/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
1	Komola Rani Das		কমলা
2	Khaila Rani Das		খাইলা রানী দাস
3	Shela Rani Das		শিলা রানী দাস
4	Rani Das		রানী দাস
5	Rita Rani Das		রীতা রানী দাস
6	Madhab Rani		মাধব
7	Rikha Rani		

MEETING LOCATION:	DATE:
Ashuganj Bazaar.	21/04/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
1	KAMRUJJAMAN MIAH (Rich mill - business)	Ashuganj	
02	ATAUR RAHMAN. (Rich mill - business)	Ashuganj.	
03	Md. Hasan - business.	Ashuganj	
04.	Md. Moziboor Rahman	Ashuganj.	

MEETING LOCATION: Sohagpur	DATE: 22/4/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
1,	S.M. Farukuzzaman (Head Teacher)	Sohagpur Achiya Safiuddin Adarsha Madhyamik School	22/4/2015
2.	Mahadeol	(illegible)	

MEETING LOCATION:	DATE:
Char Chartala	22/04/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
0	NAME: NAZRUL ISLAM VILL: CHAR CHARTALA		
②	ASHUTUS RAY VILL: CHHR CHARTALA		
③	SUJAN		
④	ALAMIN		
⑤	Mohammad Molai Mia.		

MEETING LOCATION:	DATE: 21/4/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
1.	Md. Humayun Kabir	HEADMASTER HAZI ABDUL JALIL HIGH SCHOOL, ASHUGANJ, BRAHMANBARIA	
2.	Abdul Goffar	Ashugaj Char Chartala	

MEETING LOCATION: Paltakanda

DATE: 21/4/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
(I)	md. Subor mahmud -	Paltakanda	m.d. Sobuj mahmud
(II)	md. Iran miah -	"	ইরান
(III)	md. Soman.	"	Soman
(4)	ফারজানা বেগম		ফারজানা বেগম
	রেজিয়া বেগম		রেজিয়া বেগম

MEETING LOCATION:	DATE:
Site Office (Sonarampur)	22/04/2015

SR. NO	NAME	FROM (RESIDENCE)	SIGNATURE
①	Romana Nagem	Akaishidha	
②	[illegible]	[illegible]	
	M.D. Salahuddin	Ashuganj.	
	Shahidullah Badlan	Sonarampur	
	Alamgir Hossain Farhad	Ashuganj	Alamgir

Annexure XVII

Greenbelt Development Plan

Contents

1.1 Introduction

Green plants provide a surface capable of absorbing air pollutants, thus forming an effective sink for such pollutants and reducing their concentration in the ambient air. Often, the absorbed pollutants are incorporated in metabolic stream, leaving the air purified. Plants grown in such a way as to function as pollutant sinks are collectively referred to as a 'Green Belt'. Green belts also help in reducing noise pollution.

An important aspect of green belts is that the plants constituting green belts are living organisms with limits to their tolerance of air pollutants. As a result, crossing the threshold limits in terms of pollution load, would lead to injury to plants, causing death of plant-tissues and reducing their absorption potential. Sink efficiency of unhealthy or dead plant-tissues is known to be extremely low, thus defeating the very purpose of a green belt. Thus, a green belt is effective as a pollutant sink only within the tolerance limits of its constituent plants.

1.2 Objectives of the Greenbelt

The main objectives of planting a green belt are:

- To help in the mitigation of air, water and soil pollution, including noise, generated by the project-activities
- To help in the productive use and recycling of the waste-water generated by the project
- To help in improving the aesthetics of the project site
- To enhance the ecological value of the project site

1.3 Greenbelt Plantation Plan

1.3.1 Species Recommended for Plantation

The following plants (listed in tables below), comprising different plant-habits such as trees, shrubs, climbers and herbs, are recommended for plantation in the proposed greenbelt around the UAEL's power plant at Ashuganj.

All the species included in the lists that follow are native to the Ashuganj region. They must be preferred for plantation over any species that is non-native to the region, both for the green belt and other landscape plantations within and around the project area.

It is recommended that as many plants, representing as many plant-habits and as many species as possible, from the lists that follow, must be planted in the space available for the greenbelt. This will produce diverse and multi-layered vegetation that mimics the natural forest of the region, thus greatly enhancing the ecological value of the greenbelt plantation to the ecosystem occupied by the power-plant.

Table: Large Tree Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Albizzia procera*	White Siris	Shil Kodoi
2	*Alstonia scholaris*	Blackboard Tree	Saptaparni
3	*Anthocephalus cadamba*	Common Bur Flower	Kadam
4	*Artocarpus heterophylla*	Jackfruit	Kathal
5	*Bischofia javanica*	Bishop Wood	-
6	*Bombax ceiba*	Red Silk Cotton	Tula
7	*Dalbergia sissoo*	Sissoo	Shissu
8	*Erythrina variegata*	Indian Coral Tree	Mandar
9	*Ficus benghalensis*	Bengal Fig	Bot
10	*Ficus racemosa*	Cluster Fig / Indian Fig	Jogdumur
11	*Ficus religiosa*	Bodhi Tree	Pipul
12	*Grewia oppositifolia*	-	-
13	*Haldina cordifolia*	-	Haldu
14	*Holoptelea integrifolia*	Monkey Biscuit	-
15	*Kydia calycina*	-	-
16	*Lagerstroemia parviflora*	Small Crape Myrtle	-
17	*Lannea coromandelica*	Indian Ash Tree	Jigir
18	*Mangifera indica*	Mango	Aam
19	*Melia azedarach*	Persian Lilac	Bokain / Pahadi Neem
20	*Pongamia pinnata*	Pongam	Hudo
21	*Streblus asper*	Sandpaper Leaf	Havra
22	*Syzigium cumini*	Java Plum / Jamun	Jam
23	*Terminalia arjuna*	Arjun	Arjunsadada
24	*Thespesia populnea*	Portia Tree	Pakur

Table: Small Tree Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Acacia catechu*	Black Catechu	Khair
2	*Aegle marmelos*	Wood Apple	Bel
3	*Averrhoea bilimbi*	Cucumber Tree	Bilumbi
4	*Averrhoea carambola*	Star Fruit	Kamranga
5	*Barringtonia acutangula*	Indian Putat	Ijol
6	*Bauhinia racemosa*	Bidi Leaf Tree	Banraj
7	*Cassia fistula*	Indian Laburnum	Amaltas
8	*Crataeva magna*	Holy Barna	Burum / Barun
9	*Dillenia pentagyna*	Dog Teak / Karmal	Chalta
10	*Emblica officinalis*	Indian Giooseberry / Amla	Amlaki
11	*Ficus hispida*	Hairy Fig	-
12	*Moringa oleifera*	Drumstick Tree	Shojna

Sr. No.	Scientific Name	Common Name	Vernacular Name*
13	*Premna integrifolia*	-	-
14	*Trema orientalis*	Charcoal Tree	-
15	*Trewia nudiflora*	-	Mehra
16	*Ziziphus mauritiana*	Indian Jujube	Boroi

Table: Palm Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Areca catechu*	Betel Nut Palm	-
2	*Borassus flabellifer*	Asian Palmyra / Toddy Palm	Tal
3	*Phoenix sylvestris*	Sugar Date Palm	Khejur

Table: Bamboo Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Bambusa bambos*	Indian Thorny Bamboo	-
2	*Dendrocalamus strictus*	Solid Bamboo / Calcutta Bamboo	-

Table: Shrub Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Adhatoda vasica*	Vasaka	-
2	*Ardisia solanacea*	Shoebutton Ardisia	Burum
3	*Barleria cristata*	Bluebell Barleria	Mukta
4	*Calamus tenuis*	-	-
5	*Calotropis procera*	Milkweed Bush	-
6	*Carissa congesta*	Christ's Thorn	Koromcha
7	*Helicteres isora*	Screw Bush	-
8	*Ixora coccinea*	Jungle Flame	-
9	*Kirganellia reticulata*	Black Honey Shrub	Sitka
10	*Murraya koenigii*	Curry Leaf	-
11	*Tamarix dioica*	Tamarisk / Salt Cedar	-

Table: Climbers Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Argyreia speciosa*	Elephant Creeper	Guguli
2	*Dioscorea bulbifera*	Air Potato	-
3	*Ipomoea pes-tigridis*	Tiger's Paw Glory	Anguli Lota

Sr. No.	Scientific Name	Common Name	Vernacular Name*
4	*Jasminum auriculatum*	Jasmine	-
5	*Operculina turpethum*	Indian Jalap	Tevudi
6	*Oxystelma esculentum*	Rosy Milkweed Vine	-
7	*Tiliacora acuminata*	-	-
8	*Tinospora cordifolia*	Guduchi / Giloy	Tela Pata

Table: Herb Species suggested for Plantation

Sr. No.	Scientific Name	Common Name	Vernacular Name*
1	*Abutilon indicum*	Indian Mallow	Atibala
2	*Boerhavia diffusa*	Hog Weed	Punarnava
3	*Colocasia esculenta*	Colocasia	Kochu Pata
4	*Chlorophytum tuberosum*	Musli / Spider Lily	-
5	*Commelina benghalensis*	Bengal Day Flower	Kanshira
6	*Hedychium coronarium*	White Garland Lily	-
7	*Launea procumbens*	Dandelion	-
8	*Ocimum basilicum*	Sweet Basil	Sabja
9	*Oxalis corniculata*	Yellow Wood Sorrel	-
10	*Plumbago zeylanica*	Ceylon Leadwort / Doctor Bush	Chitrak
11	*Rauvolfia serpentina*	Indian Snakewort	Sarpagandha

*The vernacular names given in the lists are either Bangla names, as gleaned from the people of Ashuganj, or the equivalent Bengali names.

1.3.2 General Guidelines for the Plantation

The original topography and vegetation of the site must be retained, so that newly-planted saplings may get the benefit of their natural micro-climate and may survive with relatively less inputs.

Soil from the site should be used for the plantation, as far as possible, and supplemented with external nutrients only where necessary.

Chemical fertilizers or pesticides must be avoided, as they reduce soil-quality and integrity, as also, the food/medicinal value of plants. Locally available leaf-litter, grass-cuttings, agricultural residue, compost or other organic material may be used as supplementary plant-nutrients.

Ground-vegetation should be allowed to shed seeds before cutting or mowing it for mulch. This would leave behind a seed-bank to flourish in the next growing-season, providing a natural source of mulch for the following year.

Burning of land must be avoided, as it reduces soil-quality, and harms the ground-vegetation, amphibians, reptiles and ground-nesting birds.

Dumping of waste on the soil must be avoided. Non-biodegradable waste must be carefully collected and safely disposed. Biodegradable waste should be collected and processed, that it may be used to enrich the site-soil.

Water-saving practices, such as drip-irrigation and mulching, are recommended.

1.3.3 Methodology for the Plantation

Pits measuring approximately 2'x2'x2' may be dug where the soil is reasonably deep, and, pits measuring approximately 3'x3'x3' where the soil is shallow or gravelly.

Expose the pits to direct sunlight for about 15 days.

If the soil at the site is reasonably good, pits may be filled with 80% site-soil + 20% composted cow-dung. About 200 gm neem-cake and leaf-litter, grass or agricultural residue may be added.

If the soil at the site is poor, pits may be filled with 35% site-soil + 35% fertile soil (from an external source) + 30% composted cow-dung. Neem-cake and other organic matter may be added, as in the previous instance.

Saplings should ideally be planted after the annual rains begin. The saplings would need to be watered once the rains cease.

Construction of temporary shelters of locally available materials such as bamboo, palm-fronds or hay around the growing saplings is recommended in the summer, to help the plants withstand the hot sun.

1.3.4 Resources required for the Greenbelt

Space

Ideally, the proposed green belt should cover at least 33% of the total project area.

This should comprise as many vacant land-patches as can be spared within the plant premises. These may include:

- Designated open spaces around the power-plant facilities
- A wide strip along the inside of the boundary walls
- Along internal roads
- along the edges of administrative buildings
- Around assembly areas.
- Footpaths lining the plant-premises

Materials

The company would need to source the following materials from the closest available nurseries, farms, vegetable markets or horticultural establishments:

- Saplings, or other planting materials, of the recommended species
- Soil, if required

- Cow-dung
- Mulching materials, such as leaf-litter, grass-cuttings, agricultural residue or vegetable waste
- Bamboo, palm-fronds or hay for summer-shelters for the growing saplings

Human Resources

UAEL would need to employ the following staff for effective development, care and maintenance of the green belt and other landscape plantations within the premises of the power plant.

- Horticulturist (one)
- Gardeners (at least two)

Annexure XVIII

Stakeholder Engagement Plan

Contents

1. STAKEHOLDER ENGAGEMENT PLAN

Stakeholder Engagement process is an important component through which an organization involves people who may be impacted or influenced by the decisions of the company. A Stakeholder Engagement Plan (SEP) detailing the purpose, scope, method, program, activities and monitoring & reporting has been prepared for UAEL. The details of the various elements involved in the stakeholder engagement process have been discussed in the following sections:

1.1 Purpose and Scope of Stakeholder Engagement Plan

1.1.1 Purpose

Stakeholder consultations are important processes through which a two way dialogue is created between the project proponents and the stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. They can comprise individuals, communities, social groups, organizations etc. As per World Bank's Policy on Disclosure of Information, 2002 participation of pubic is necessary as it is a two way process wherein people learn about and have input into design of projects that affect their lives, well-being and environment.

By identifying and consulting all stakeholders, especially the poor and the vulnerable, it is essential to ensure that the project meets the need of all sections of the people. Stakeholder engagement is a continuous and inclusive process encompassing various activities and interactions between the project proponents and the stakeholders over the entire life of the project. The purpose of the Stakeholder Engagement Plan (SEP) is to ensure that the direct and indirect impacted stakeholders of the project are regularly apprised of the project activities. The plan has been developed in order to draw out an outline wherein the communication and consultation process associated with the activities of the project cycle is to be undertaken. The SEP would also include delineating the stakeholders, the extent of impact on various stakeholders, extent and plan of communication and engagement around the different phases of the project, and management of grievances by the appropriate authority within its purview.

1.1.2 Scope of Work

This SEP is prepared by AECOM based on the following frameworks of undertaking a site visit and understanding the project life cycle and its impact on various stakeholders.

The scope of the SEP will provide the following key components:

- Brief description of the applicable Standards and Regularity Requirements
- Communicative Methods
- Stakeholder Engagement Program
- Monitoring and Reporting

1.2 Stakeholder Engagement Principles

Stakeholder engagement is about building and maintaining constructive relationships over time. It is an ongoing process between a project proponent and its project stakeholders that extends throughout the life of the project and encompasses a range of activities and approaches, from information sharing and consultation, to participation, negotiation and partnerships.

The rationale of it is to describe a company's strategy and program for engaging with stakeholders in a culturally appropriate manner (whether it is for a single project or a range of company operations). The goal is to ensure the timely provision of relevant and understandable information. It is also to create a process that provides opportunities for stakeholders to express their views and concerns, and allows the company to consider and respond to them.

Key principles of effective engagement include:

- Providing meaningful information in a format and language that is readily understandable and tailored to the needs of the target stakeholder group(s)
- Providing information in advance of consultation activities and decision-making
- Disseminating information in ways and locations that make it easy for stakeholders to access it
- Respect for local traditions, languages, timeframes and decision- making processes
- Two-way dialogue that gives both sides the opportunity to exchange views and information, to listen, and to have their issues heard and addressed
- Inclusiveness in representation of views, including women, vulnerable and/or minority groups
- Processes free of intimidation or coercion
- Clear mechanisms for responding to people's concerns, suggestions, and grievances
- Incorporating feedback into project or program design and reporting back to stakeholders.1

1.3 Applicable Standard And Regularity Framework

1.3.1 National Laws, Policies and Regulatory Framework

The National Environmental Policy, 1992

The policy gives reference to education and public awareness by creating awareness amongst the population pertaining to environmental conservation and improvement, sustainable, long term and environmentally sound utilization of all resources. Spontaneous and direct participation of people in all environmental activities has been ensured through this policy as well. The key provisions of the policy are related to developing an initial environmental examination (IEE) and environment impact assessment (EIA) of all new public and private sector industrial project which is mandatory.

The Environmental Conservation Rules, 1997 as amended till 16th February, 2002

This law provides guidelines in terms of conservation in a sustainable development manner by issuance of an Environmental Clearance Certificate. There is no specific mention of public disclosure

[1] IFC Stakeholder Engagement (2007): *A Good Practice Handbook for Company doing Business in Emerging Markets*, Appendix 3; Pg. 164

and consultation mentioned in the document, however, for projects falling within the 'red' category, reference has been given to the conduct of an Environment Impact Assessment study to assess the risks and impacts involved in the project activities to be undertaken by Entrepreneur or Organization that may cause a significant impact on the environment.

1.3.2 World Bank Operational Policies

World Bank has developed certain operational policies pertaining to the disclosure of information and continuous engagement with stakeholders. These reference documents are as follows:

- The Operational Policy (OP 4.01) issued on January 1999
- The Operational Policy (OP 4.12) issued on December 2001
- The World Bank Policy on Disclosure of Information, June 2002
- The World Bank Policy on Access to Information, 2002

1.3.3 The International Finance Corporation (IFC) Policies

Certain guidelines of IFC were considered encompassing stakeholder engagement and public disclosure. These reference documents are as follows:

- IFC Sustainability Framework 2012 edition,
- The Performance Standard 1: Social and Environmental Assessment and Management System updated in January 2012,
- The Performance Standard 5: Land Acquisition and Involuntary Resettlement updated in January 2012,
- The Guidance Note 5: Land Acquisition and Involuntary Resettlement which is updated in January 2012
- IFC's Stakeholder Engagement: A Good Practice Handbook for Company doing Business in Emerging Markets, 2007

1.4 Communicative Methods

Stakeholder engagement becomes a successful exercise when proper and participatory communicative methods are used. This ensures that the stakeholders are kept engaged and well informed of the project development at every stage. A combination of communicative methods is usually used to engage with the stakeholders. To determine which option is best suited to the various stakeholders, a benefit analysis of each option has been carried out. The communicative methods are:

- General Information consisting of the project's various activities, the operation stage and impacts that might arise shall be made available:
  - on information board of Ashuganj Union Parishad's office
  - on information board of UAEL's site office
  - on UAEL's website
  - in local newspaper

- Detailed information including documents like ESIA report; Environment, Health & Safety and Social Policy, Environment Management Plan, Social Management Plan including environmental decisions shall be in hard copies and disseminated to:
  - Ashuganj Union Parishad
  - UAEL's site office at Sonarampur
  - Electronic version of these documents will be made available at UAEL's website.

- In addition to this, a host of tools and techniques can be adopted to engage with the stakeholders in a transparent and accountable manner. Below a list of the tools and techniques which can be adopted are mentioned:
  - Public Meeting: This tool can be used to disclose information on a large scale involving the stakeholders of a particular village. A schedule of the meeting can be circulated well in advance and discussions can involve feedback session from the stakeholders. The meeting can be conducted in the premise of the village school for proximity and familiarity purposes. Once the meeting concludes, minutes of the same should be kept as a record with the site office and a copy given to the village head. Schedules of future meetings should be discussed and finalised so that the stakeholders can gauge the seriousness of the project proponent in continuing the engagement process.
  - Focus Group Discussion (FGDs): FGDs are important when gauging with a particular group of stakeholder on issues related to the project activities. It can be used to understand the needs, perceptions and concerns of the group. The discussion will give space for the members to voice their concerns and suggestions. The moderator of the discussion should be impartial in his/ her view and should encourage everyone present to participate in the discussion. Records of the FGDs should be maintained and updated regularly.
  - Participatory Workshops: Participatory workshops are meetings which enable local people to analyse, share and enhance their knowledge to plan, manage and evaluate development projects and programmes. Visual aids – such as mapping, videos, illustrations, timelines, card sorting and ranking, Venn diagrams, seasonal calendar diagramming and body maps are often used in participatory workshops to engage participants and capture knowledge. They are often an effective means of getting participants to reflect on issues and their own personal experiences. These workshops also pay particular attention to group dynamics and breaking down distinctions between 'uppers' – those with power, standing, influence etc within a community – and 'lowers' – those with less power, influence and standing within a community. To initiate such a workshop, an expert familiar with participatory tools and conducting such workshops shall be engaged.
  - Participatory Rural Appraisal (PRA) Techniques: PRA techniques are usually adopted to emphasize local knowledge by enabling local people to make their own appraisal, analysis and plan. PRA uses group animation and exercises to facilitate information sharing, analysis and action among stakeholders. This process can be useful when the project proponent initiates any developmental activities in the area and uses the local knowledge to plan and strategise so that they feel responsible for delivery of the objectives.

1.5 Stakeholder Engagement Program

The consultation with the stakeholders will be conducted by the HR & Admin Officer who will also perform the responsibilities of a Community Liaison Officer and will work in collaboration with the nominated (Grievance Officer) and Plant Manager at the site level. Any grievances from the community relating to any issues that might arise from the project activities will be managed by the nominated Grievance Officer based at the Site Office. The Community Liaison Officer is to report directly to the Plant Manager based at the Site level.

Consultations with the government agencies will be conducted as per the schedule that will be created with the HR& Admin Officer and Project Manager. These stakeholders will be informed in advance of the planned project activities. The development of the facilities will be based on the EIA procedures and mitigation issues once an ESIA study has been completed. Information on the summary of the ESIA draft has already been uploaded on UAEL's website however, a copy of the same will also be disclosed to the public (Ashuganj Union Parishad office) in the local language for easier accessibility.

Consultations with the direct internal stakeholders will involve meetings, information boards announcements and an Intranet system to apprise the direct employees of UAEL regarding the procedures of emergency response system, incident/accident reporting, grievance redressal mechanism, HR Policies and Procedures, welfare measures etc. In addition, communication of general employment conditions, company's code of conduct for work site, EHS concerns, use of PPEs, information and awareness about the requirements of labour laws and minimum wages, working hours, grievance redressal, retrenchment process etc. should be also be conducted with workers engaged with contractors.

Project related information will be posted on the informational boards at the site office as well as at the Corporate Level. Information on the project milestones will be published in advance on the company's website to be available for the public and non-governmental organizations in the area to comprehend the attitude of the external stakeholders. In addition, the company will publish information on the project in the local newspapers.

In turn, if any issues are raised by the stakeholders, the project proponent management comprising of the Grievance Redressal Committee at the Site Level will respond accordingly in the shortest possible time. Details of which have been provided in the Grievance Redressal Mechanism section of the report.

The responsibility for the SEP implementation will be held by the Community Liaison Officer (HR& Admin Officer) based at the Site Office. He will be supported by the Director (Operations), Project Manager , Plant Manager, Environment Compliance Officer , Safety Officer and nominated Grievance Officer at the site level.

A summary of the consultation activities that the project proponent shall undertake as part of the Engagement Plan pertaining to the villages around the project area and other stakeholders have been provided in (Table 1-1),

Table 1-1: Summary of the Consultation Activities

Stakeholder	Objective and Consultation Method	Proposed Timeline	Responsibility
Local Community, NGO, Opinion Leaders, Local Media at Project Site	• Announcement of the project at Sonarampur village, summary of ESIA draft and progress of the work to be displayed at the Information Board of Ashuganj Union Parishad office/ community building. • Website of the Company (already initiated by the Company)	May 2015	Community Liaison Officer from the Company and Local Administration (involving Chairman of Ashuganj Union Parishad)
Government Authorities	Information meetings and consultations	On-going on a permanent basis (every six monthly)	Company: Director (Operations), Project Manager, Environment Compliance Officer and Community Liaison Officer
Direct Employees	• Internal meetings of direct employees and managers • Day to day contact	• On-going process on a permanent basis: monthly • On-going on a permanent basis	• Company: Project Manager, Plant Manager, Safety Officer & Community Liaison Officer • Safety Officer
Contractors (Third Party)	• Meetings with contractors and their respective managers	On-going on a permanent basis: monthly basis	Safety Officer, Environment Compliance Officer and Community Liaison Officer
Lenders	• Information on project status • Submission of annual reports, information on any project-related events that could potentially create an increased risk of the project	On-going process on a permanent basis	Company: Director (Operations); designated person from UECL, Environment Compliance Officer and Community Liaison Officer.

The stakeholder engagement process should be carried out at two levels, namely, local community and local governing bodies. As per the need assessment undertaken during the socio-economic survey exercise during the ESIA study, certain activities were highlighted by the communities and local government authorities that are required to be undertaken in the local communities within the project area which have also been included in the proposed plan of activities. A summary of the proposed plans that is to be initiated by UAEL have been described below in (Table 1-2).

Table 1-2: Summary of the proposed plan of Activities

S.N	Key Stakeholders	Proposed Plan of Activities
1	Project Influenced Stakeholders/ Local Communities	• Announcement of vacancies (skilled/unskilled) at proposed site • Announcement of contract work for small scale work associated with the proposed project • Skill development training centre in the village to develop skills like electrician, plumbing, welding etc. • CSR Activities - Distribution of Solar Powered Lanterns to Char Sonarampur Population - Provide services of Company Doctor to conduct visits and consultations of population in Char Sonarampur - Institutional support to middle and senior schools - Infrastructural support of primary schools in the project influenced villages - Vocational training centres for men and women - Distribution of Chlorine Tablets - Training & capacity building of health care outreach workers - Ambulance facilities to provide emergency medical care
2	Local Governing Bodies	• Compliance with legal requirements • Involvement of various CSR Activities
3	Lenders	• Compliance with International Guidelines (IFC Sustainability Framework, World Bank Operational Policies & other national and local legal requirements) • Regular Reporting

It is to be noted that the proposed plan of activities relating to the stakeholder engagement can change as per the submission and approval of the ESIA report for proposed project as well as the future planning of activities by UAEL.

1.6 MONITORING AND REPORTING

Monitoring. Monitoring of project activities is necessary to cater to the stakeholder's concerns by ensuring transparency in guaranteeing the project proponent's commitment in implementing the mitigation measures that addresses the environmental and social impacts arising from the project.

Through this information flow, the local stakeholders feel the sense of responsibility for the environment and welfare in relation to the project and feel empowered to act on issues that might affect their lives.

Internal monitoring of project related activities as well as associated activities involving the local communities should be contemplated upon on a regular quarterly basis (by identified staff from the Corporate level) to bring in openness in the company's commitment. In addition, external monitoring of a company's environmental and social commitments can strengthen stakeholder

engagement processes by increasing transparency and promoting trust between the project and its key stakeholders.

UAEL should undertake a commitment in undertaking internal audits every quarter. All related information shall be readily maintained at the site office and produced at the time of the audits.

Audit reports shall be accordingly created after every quarterly audit and submitted to Director (Operations). All records of these reports shall be maintained at the site office as well as the Corporate Office. In addition, an external auditor shall be engaged every six monthly to assess the activities of the project and its mitigation measures. The auditor shall accordingly submit a report to the company for review and this should be forwarded to the lender financing the project as well.

Reporting. Performance of UAEL will be reviewed quarterly against the Stakeholder Engagement Plan. The report will include, but not be limited to, the following:

- Informative materials disseminated, its types, frequency, and location;
- Place and time of formal engagement events and level of participation
- Activities of community welfare undertaken
- Feedback on CSR initiatives
- Other interactions with the community; and
- Numbers and types of grievances (both from the community and workers) and the nature and timing of their resolution.

Annexure XIX

Occupation Health and Safety Plan

Contents

1.1 Scope and Objective

The purpose of this Health & Safety (H&S) Plan is to identify hazards and risks associated with the power plant project during the operation phase and further recommend guidance on safe working conditions. H&S plan also lists out requirements to statutory compliance based on applicable World Bank (WB) General EHS Guidelines, WB EHS Guidelines for thermal Power plants and WB EHS Guidelines for Gas Distribution Systems, applicable national and state laws/rules, and regulations.

The H&S plan is applicable to all employees of UAEL, including their staff, contractors, and labourers. It is recommended that UAEL work out an arrangement to ensure implementation of the H&S plan during the contract phase itself. This may further be vetted by UAEL by creating daily, weekly and monthly HSE checklist for site specific tasks and equipment and work environment. UAEL's safety officer and team will in turn monitor implementation of the same requirements.

It is recommended that UAEL should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

Hierarchy of Hazard Control should be used to minimize or eliminate exposure to hazards. Hazards in turn are identified by the UAEL management (for contractor workers also) by using dedicated tools of risks and hazards assessment. The hazard control hierarchy in order of decreasing effectiveness is provided below:

- Elimination: Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
- Substitution: Substitution involves replacing something that produces a hazard (similar to elimination) with something that does not produce a hazard
- Engineering: Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- Administration: Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- Personal protective equipment: Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE

The application of prevention and control measures to occupational hazards should be based on comprehensive Job Safety or Job Hazard Analysis. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. UAEL should carryout detail Hazard identification and risk assessment exercise for all its activities throughout the power plant and provide training and implement the same at site.

1.2 Policy

UAEL is advised to develop and implement Occupational Health and Safety (HS) Policy which should be formally endorsed by the UAEL Senior Management. The policy should be communicated to all direct and indirect employees. The policy should be displayed at the site office and other conspicuous locations within the project site.

1.3 Roles and responsibility (reporting structure)

UAEL has a dedicated safety team for the project site which comprises of one (1) Safety Manager and two (2) Safety Officers. The roles and responsibilities of the Safety Manager and Safety officers is provided in the Section 8.2. The safety team will work in coordination with O&M team and will be responsible for overall health & safety of the employees working within the project site.

1.4 Identified Hazards/ Risks

UAEL should carryout detail Hazard identification and risk assessment exercise for all its routine and non-routine activities throughout the project site and provide training and implement the same at site.

There are several aspects of Health and Safety which should be known to all the employees and workers working at UAEL. Some of the occupational health and safety hazards identified for UAEL Project Site include:

- Non-ionizing radiation
- Heat
- Noise
- Confined spaces
- Hazardous Energy (including electrical hazards)
- Fire and explosion hazards
- Chemical hazards

1.5 Procedures of Mitigation for each hazard

Project should develop a procedure for identification of risks and hazards identified in the project-site for all the direct and indirect operations including all workers. The procedure should be able to identify hazards, provide option for assigning a severity class and likelihood. The mitigation measures identified in the procedure should calibrate the risk based on hierarchy of controls.

Bradly, the hazards identified/perceived for the power plant and precautions to be taken are described below:

1.5.1 Non-ionizing radiation

Combustion facility workers may have a higher exposure to electric and magnetic fields (EMF) than the general public due to working in proximity to electric power generators, equipment, and connecting high-voltage transmission lines. An EMF safety programme should be developed to prevent or minimize exposure of workers to EMF. The EMF safety plan should include the following:

- Undertake workplace survey of EMF levels and identify potential exposure levels at the workplace
- Provide workplace zonation based on the results of the survey as Safe and Active zone based on Table 1.1, wherein exposure based threshold has been defined based on International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines.

Table 1: Exposure limits for Electric and Magnetic Fields

ICNIRP exposure limits for occupational exposure to electric and magnetic fields.		
Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	10,000	500
60 Hz	8300	415

Source: ICNIRP (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)

- Definition of Safe and Active Zone
    - Safe Zone: Zones with lower level of electric and magnetic field based on exposure limits defined in Table 1
    - Active Zone : Zones with higher level of electric and magnetic field and magnetic field based on exposure limits defined in Table 1
- Safe zone to be provided with dedicated EMF monitors to identify any instance of change of zonation (from safe to active)
- Limit access to Active Zones and restrict access to only trained workers on EMF
- Workers/employees should be trained for identification of occupational EMF Levels and hazards
- Workers working in the active zone should be provided with Personal exposure monitoring equipment. The equipment should be set to warn of exposure levels that are below occupational exposure reference levels as given in Table 1 (e.g., 50 percent).
- Management should plan for limiting occupational exposure by using the following measures:
    - Limit exposure time through work rotation,
    - increase the distance between the source and the worker, when feasible,
    - Use of shielding materials.
- The EMF monitors and Personal exposure monitoring equipment should be calibrated at specified duration as detailed in the technical specification manual of the equipment.

1.5.2 Fire and Explosion Hazards

As the project is gas based and is prone to fire and explosion hazards due to flammability and explosive (in case of leakage near the source) nature of natural gas, the project management should develop comprehensive procedure for management of fire and explosion risks. The management programme should incorporate the following elements:

- Use of flame arresting devices on vents from flammable storage containers
- Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials
- Storage of other flammable materials in an area of the facility separated from the shop floor. Where proximity is unavoidable, physical separation should be provided using structures designed to prevent fire, explosion, spill, and other emergency situations from affecting facility operations.
- Prohibition of all sources of ignition from areas near flammable storage tanks
- Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations. Acceptable leak detection methods include:
    - Use of automatic pressure loss detectors on pressurized or long distance piping

  - Use of approved or certified integrity testing methods on piping or tank systems, at regular intervals
- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
  - Remote from entry and exit points into buildings
  - Away from facility ventilation intakes or vents
  - Have natural or passive floor and ceiling level ventilation and explosion venting
  - Use spark-proof fixtures
  - Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
- Additionally, to prevent, minimize and control physical hazards, the following should be sued
  - Use of automated combustion and safety controls;
  - Proper maintenance of boiler safety controls;
  - Developing and implementing a system of Pre-start-up Safety Review (PSSR)
  - Implementation of start-up and shutdown procedures to minimize the risk of gas leakage during start-up;
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression

1.5.3 Exposure to Heat

Occupational exposure to heat occurs during operation and maintenance of combustion units, pipes, and related hot equipment. Recommended prevention and control measures to address heat exposure at the project site include:

- Regular inspection and maintenance of pressure vessels and piping;
- Provision of adequate ventilation in work areas to reduce heat and humidity;
- Reducing the time required for work in elevated temperature environments and ensuring access to drinking water;
- Shielding surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc;
- Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes.

1.5.4 Hazardous Energy (including electrical hazards)

Employees servicing or maintaining machines or equipment may be exposed to serious physical harm or death if hazardous energy like electrical, pneumatic or others, is not properly controlled. A dedicated and comprehensive lockout/tagout (LOTO) programme ensures identification of such sources and isolation before any operations and maintenance works. Following elements should be followed for development of a comprehensive LOTO programme:

- Identification of sources of hazardous energy: A dedicated employee (LOTO In-charge), maintenance in-charge and safety professional, should identify all sources of hazardous energy in the project-site and in associated utilities. Before any maintenance programme, a revivification of LOTO points should be undertaken. A LOTO register and a LOTO kit to be procured for the LOTO points identified (based on various valves size, witch points, pipe-lines, etc.)
- Disconnection: Maintenance Engineer shall ensure, with the assistance of LOTO In-Charge, disconnection of the equipment to be repaired or modified or under maintenance from its power supply sources (electricity, pressure, heat, etc.).
- Locking and tagging: LOTO In-Charge shall ensure locking the disconnected devices and positioning the markings.
- Dissipation or retention / containment: Site Supervisor and Maintenance Engineer shall ensure, with the assistance of LOTO In-Charge, evacuation of all potential and residual energies and, when this is not possible, retention or containment of the energies.
- Checking and identification: Site Supervisor and Maintenance Engineer shall ensure, with the assistance of LOTO In-Charge , checking for the absence of energy.
- Maintenance Engineer shall conduct tool-box meeting with the LOTO In-Charge and maintenance workers, informing them about the requirements, hazards involved and protective measures to be ensured while performing the tasks.
- Training of employees.

The LOTO Programme should include atleast the following points:

- All maintenance personnel shall be provided with a good lock. The lock shall have the individual workers' name and other identification on it. Each worker shall have the only key to the lock.
- The worker shall check to be sure that no one is operating the machinery BEFORE turning -off the power. The machine operator shall be informed before the power is turned off. Sudden loss of power could cause an accident
- Steam, air and hydraulic lines shall be bled, drained, and cleaned out. There shall be no pressure in these lines or in reservoir tanks.
- Any mechanism under tension or pressure, such as springs, shall be released and blocked.
- Each person who will be working on the machinery shall put a lock on the machine's lockout device(s). Each lock shall remain on the machine until that worker's work is complete.
- All energy sources that could activate the machine shall be locked out (blocked/tagged).
- The main valve or main electrical disconnect shall be tested to be sure that the power to the machine is off.
- Electrical circuits shall be checked with proper and calibrated electrical testing equipment. An electrical failure could energize the equipment even if the switch is in the off position. Stored energy in electrical capacitors shall be safely discharged.
- When working on machinery such as power presses and welding presses that have a ram that could fall, the ram shall be supported with safety blocks or pins. Fully interlocked safety blocks are the safest. A sample permit for LOTO is provided in section on Permit to Work System.

Electrical Safety

Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

- Marking all energized electrical devices and lines with warning signs · Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools
- Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas
- Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited;
- Establishing "No Approach" zones around or under high voltage power lines in conformance with Table 2
- Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work

Table No 2. No approach zone for High Voltage Power Lines

Nominal phase to phase voltage rating	Minimum distance
750 or more volts, but not more than 150,000 volts	3 meters
More than 150,000 volts but not more than 250,000 volts	4.5 meters
More than 250,000 volts	6 meters

1.5.5 Confined Spaces

Specific areas for confined space entry may include turbines, condensers, and cooling water towers, etc. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. A Confined Space Entry Programme should incorporate the following:

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.
- Prior to entry into a permit-required confined space:

- Process or feed lines into the space should be disconnected or drained, and blanked and locked-out.
- Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.
- The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
- If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE.

- Safety precautions should include Self Contained Breathing Apparatus (SCBA), life lines, and safety watch workers stationed outside the confined space, with rescue and first aid equipment readily available.
- Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space. A sample permit for Confined Space entry is provided in section on Permit to Work.

1.5.6 Permit to Work System

The program for hazardous work permit provides a formal control system aimed at prevention of accidents and damage to property in cases where foreseeable hazardous work is to be carried out. The program for hazardous work permit consists of documents which:

- Describe the work to be done
- Describe the type and scope of work
- Associated potential hazards
- Define the required control measures to be implemented
- State the Acceptance/ Cancellation of the permit
- List other permits in operation

- The issue or display of Permits does not make a job free from risks, rather it helps in ensuring provision of effective control and coordination, so that hazards are identified and risks are suitably assessed (Refer to Job Safety Analysis Program).
- The Issuing Authority needs to ensure that the following information is fully documented on the Hazardous Work Permit form:
  - Type of Permit – i.e. Hot Work permit, Confined Space Entry permit, etc.
  - Unique Permit Number
  - Location of work
  - Details of the work to be carried out
  - Identification of hazards associated with the works
  - Precautions required to prevent or mitigate the hazards
  - Personal Protective Equipment required
  - Clearance from EHS Executive/Coordinator

- Authorization to commence work
- Any extension of permit time
- Clearance of the work site after the completion of work
- Cancellation of the permit

- When the work involves the use of onsite contractors, the facility shall assign a facility representative (In charge of maintenance work, as generally maintenance work involves lot of contractor workers) who shall obtain the work permit on contractors' behalf.
- For hazardous operations like electrical works, confined space entry, etc. is provided in Annexure A

1.5.7 Fire and Explosions

Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include: ·

- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
  - Remote from entry and exit points into buildings
  - Away from facility ventilation intakes or vents
  - Have natural or passive floor and ceiling level ventilation and explosion venting
  - Use spark-proof fixtures o Be equipped with fire extinguishing devices and self closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems.
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression
- Adequate precaution shall be taken while working close to gas pipeline, strict guidelines and procedures shall be put in place for digging, drilling or any construction activity close to pipeline.
- No smoking areas shall be identified and marked.

1.6 Incident Reporting

Any incident or activity irrespective of its severity shall be reported and recorded. The Safety Officer shall thoroughly investigate the actual cause of the injury and the potential corrective actions to prevent future incidents. Proper documentation shall be maintained in timely and accurate manner to mitigate against similar situations which lead to the accident causing another accident. Incident investigation form is attached as Annexure A.

1.7 Safe working Conditions

1.7.1 Potable Water Supply

Adequate supplies of potable drinking water should be provided with a sanitary means of collecting the water for the purposes of drinking. Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards.

1.7.2 Lighting

Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met. Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

1.7.3 Safe Access

Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access. Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access. Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

1.7.4 First Aid

UAEL should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work.

- Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first aid room(s) should be provided. First aid rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids

1.7.5 Work Environment Temperature

The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

1.7.6 Area Signage

Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately. Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

1.7.7 Labelling of Equipment

All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, should be labelled as to the contents and hazard, or appropriately colour coded. Similarly, piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or colour coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

1.7.8 Communicate Hazard Information

Copies of the hazard coding system should be posted outside the facility at emergency entrance doors and fire emergency connection systems where they are likely to come to the attention of emergency services personnel. Information regarding the types of hazardous materials stored, handled or used at the facility, including typical maximum inventories and storage locations, should be shared proactively with emergency services and security personnel to expedite emergency response when needed. Representatives of local emergency and security services should be invited to participate in periodic (site inspections to ensure familiarity with potential hazards present.

1.7.9 Noise

Noise sources in combustion facilities include the turbine generators and auxiliaries; boilers and auxiliaries, such as diesel engines; fans and ductwork; pumps; compressors; condensers; precipitators, including rappers and plate vibrators; piping and valves; motors; transformers; circuit breakers; and cooling towers. The following should be ensured for the operations:

- Provision of sound-insulated control rooms with noise levels below 60 dBA ;
- Design of generators to meet applicable occupational noise levels;
- Identify and mark high noise areas and require that personal noise protecting gear is used all the time when working in such high noise areas (typically areas with noise levels >85 dBA).
- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A). Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the ‘allowed’ exposure period or duration should be reduced by 50 percent. Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible. Periodic medical hearing checks should be performed on workers exposed to high noise levels.

1.7.10 Vibration

Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the manufacturer. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

1.7.11 Industrial Vehicle Driving and Site Traffic

Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits
- Ensuring drivers undergo medical surveillance
- Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction
- Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate

1.7.12 Working at Heights

Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area
- Proper use of ladders and scaffolds by trained employees
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines
- Appropriate training in use, serviceability, and integrity of the necessary PPE
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall
- Permit to work system shall be followed for height work.

1.7.13 Welding / Hot Work

Welding creates an extremely bright and intense light that may seriously injur a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated.
- Permit to work system shall be followed for hot work.
-

1.8 Training

1.8.1 Occupational Health and Safety (OHS) Training

UAEL should provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees. Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or colour coding in use should be thoroughly reviewed as part of orientation training.

1.8.2 New Task Employee and Contractor Training

UAEL should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present. The training should adequately cover:

- Knowledge of materials, equipment, and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents

1.9 Monitoring

Occupational health and safety monitoring programs should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant

occupational, health, and safety hazards, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

- Safety inspection, testing and calibration: This should include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection should verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters should be regularly tested and calibrated, and the respective records maintained.
- Surveillance of the working environment: UAEL should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards.
- Training: Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the UAEL adequate training documentation before start of their assignment.

1.10 Reporting

The UAEL should establish procedures and systems for reporting and recording:

- Occupational accidents and diseases
- Dangerous occurrences and incidents

These systems should enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health.

The systems and UAEL should further enable and encourage workers to report to management all:

- Occupational injuries and near misses
- Suspected cases of occupational disease
- Dangerous occurrences and incidents

All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses should be investigated with the assistance of a person knowledgeable/competent in occupational safety.

The investigation should:

- Establish what happened
- Determine the cause of what happened
- Identify measures necessary to prevent a recurrence

ELEVATED WORK PERMIT

Permit S/N: _____
Date: _____

SECTION A

Facility ID: Work Location:	Work Description with associated Hazards::	
Permit Issued to:	Name & Signature of Indenter: _____ Designation: _____	
Permit Duration:	(STARTS) Date :_____ Time:_____	(ENDS) Date :_____ Time:_____
Any Additional Permit Required? (Give details)	_____ _____ _____	

SECTION B

REQUIRED PPE		EQUIPMENT & MAN-POWER		WORK SITE PREPARATIONS	
Lanyards	☐	Warning Lines/Caution Signs	☐	Posting of Warning Signs & Mark Outs	☐
Self Retracting Lifeline	☐	Permanent Walkways	☐	Removal of Obstructions	☐
Full Body Harness	☐	Guardrail Protection System	☐	Limit Access to Site & Securing Area	☐
Seat belts/Restraints	☐	Mobile Access Platforms	☐	Inspection of Equipments and Tools	☐
Hard Hat	☐	Scaffolds (Static/Mobile)	☐	Rescue Plan Preparation	☐
Safety Vest	☐	Ladders	☐	Safety Meeting	☐
Safety goggles	☐	Safety Net System	☐	Establishing Communication	☐
Rubber Soled Shoes	☐	Tools & Equipments for Work	☐	Mechanical Isolation	☐
Leather Gloves	☐	Communication Equipment	☐	Electrical Isolation	☐
First Aid	☐	Rescue Equipment & Crew	☐	Others	☐
Others	☐	Health & Safety Executive	☐		☐
	☐	Supervisor	☐		☐

Special Precautions:

SECTION C

Electric Isolation Details	Signature of person who isolates		
Mechanical Isolation Details	Signature of person who isolates		
Weather conditions Acceptable ?	**Precautions Taken**	Any Over-head Service Lines Present?	**Precautions Taken**

SECTION D

I have reviewed this permit and I am fully aware of the hazards and precautions necessary for the performing the designated work authorized by this permit. I shall be responsible for all the workers involved in this designated work and their adherence to the provisions of this permit program.

_____

Name & Signature of Indenter/ Supervisor

Names of Authorized Workers

1._____ **2.**_____ **3.**_____

4._____ **5.**_____ **6.**_____

7._____ **8.**_____ **9.**_____

SECTION E

I confirm that all necessary precautions have been taken to perform the work safely:

Name /Sign. of **EHS Executive:** _____ Date/Time: _____ @ _____ Hrs

Name /Sign. of **Plant Area Supervisor/HoD**_____Date/Time: _____ @ _____ Hrs

I confirm that all precautions and safety measures are in place & the work can be permitted to be carried out:

<table>
<tr><td colspan="3">Name:_____
Signature:_____Designation:_____</td><td>Date:_____
_
Time:_____
_</td><td rowspan="3">SECTION F</td></tr>
<tr><td>Permit Extension

up to :</td><td>(Date & Time)
_____
___</td><td colspan="2">(Reason for Extension)
_____
_____</td></tr>
<tr><td colspan="4">Name &
Signature_____Designation_____
_</td></tr>
<tr><td colspan="2">Work Completed?
Worksite Returned to Normal?
Isolated Equipment De-isolated
Permit Closed?</td><td>Checked & Found OK</td><td colspan="2">Signature/Time (PAI): _____@ _____Hrs

Signature/Time (EHS):_____@ _____Hrs</td></tr>
</table>

GUIDELINES FOR ELEVATED WORK PERMIT

1. The permit shall be issued in triplicate.

Copy 1 (Colour)	To be held with On-site Work Supervisor
Copy 2 (Colour)	To be displayed at on-site Notice Board
Copy 3 (Colour)	To be submitted to EHS Executive

2. The duration of the permit shall be for one shift unless work continues beyond that shift with the same personnel.

3. However, any work required to be done beyond the permitted hours shall be done with a permit extension approval from the Supervisor obtained 30 minutes before the permit expiry time.

4. For extension all three copies must be signed by concerned authority specifying the reason for extension.

5. All work must be done between 8.30 AM and 5.30 PM. Any work to be done beyond 5.30 PM shall also require a permit extension taken 30 minutes in advance from Supervisor.

6. Ensure proper illumination in case of night work.

7. The authorized person of electrical department shall check the relevant points mentioned in the work permit & ensure the equipment free from the electrical hazard.

8. The authorized person of Mechanical department shall check the necessary points mentioned in the work permit & ensure the equipment free from the Mechanical hazard.

9. The Supervisor shall verify whether all the necessary conditions mentioned in the permit are complied & safe to do the job.

10. It shall be the responsibility of the concerned department in-charge to maintain the conditions of the area throughout the work as checked during the duration of permit.

11. The separate work permit (Confined Space Entry Permit, Elevated Work Permit etc.) shall be obtained if any other hazardous wok is involved.

12. After completion of the job do proper housekeeping.

13. After the completion of the work, the permit shall be promptly closed and submitted to Supervisor.

LIVE ELECTRICAL WORK PERMIT

Permit S/N: _____
Date: _____

SECTION A

Facility ID:
Work Location:

Work Description with associated Hazards::

Permit Issued to:

Name & Signature of Indenter:
_____

Designation:
_____

Permit Duration:

(STARTS) Date :_____ Time:_____

(ENDS) Date :_____ Time:_____

Any Additional Permit Required? (Give details)

_____
_____
_____

SECTION B

REQUIRED PPE		EQUIPMENT & MAN-POWER		WORK SITE PREPARATIONS	
Eye Protection		Warning Lines/Caution Signs		Posting of Warning Signs	
Ear Protection		Communication Equipment		Removal of Obstructions	
Protective Clothing		Fire Fighting Equipment		Limit Access to Site & Securing Area	
Apron		Tools & Equipments for Work		Inspection of Equipments and Tools	
Rubber Gloves		Ground Fault Interrupter		Fire Fighting & Rescue Equipment	
Hard Hat		Electrician		Tool Box Meeting	
Foot Protection		Electrical Safety Engineer		Mechanical Isolation	
Safety Goggles		Health & Safety Executive		Electrical Isolation	
Grounded Elec. Equip		Plant Supervisor		Shock/Flash Hazard Analysis	
First Aid		Others		Others	

Special Precautions:

SECTION C

Electric Isolation Details	Signature of person who isolates
Mechanical Isolation Details	Signature of person who isolates
Shock/Flash Hazard Analysis	Signature of person who performs the task

SECTION D

I have reviewed this permit and I am fully aware of the hazards and precautions necessary for the performing the designated work authorized by this permit. I shall be responsible for all the workers involved in this designated work and their adherence to the provisions of this permit program.

_____
Name & Signature of Indentor/ Supervisor

Names of Authorized/Qualified Workers

1_____ **4**_____ **7**_____
2_____ **5**_____ **8**_____
3_____ **6**_____ **9**_____

SECTION E

I confirm that all necessary precautions have been taken to perform the work safely:

Name /Sign. of **EHS Executive:** _____ Date/Time: _____ @ _____ Hrs

Name /Sign. of **Plant Area Supervisor:** _____Date/Time: _____ @ _____ Hrs

I confirm that all precautions and safety measures are in place & the work can be permitted to be carried out:

Name:_____ Signature:_____Designation:_____		Date:_____ _ Time:_____ _	
Permit Extension up to :	(Date & Time) _____ ___	(Reason for Extension) _____ _____	
Name & Signature_____**Designation**_____ _			
Work Completed? Worksite Returned to Normal? Isolated Equipment De-isolated **Permit Closed**?		**Checked & Found OK**	Signature/Time (PAI): _____@ _____Hrs Signature/Time (EHS):_____@ _____Hrs

SECTION F

GUIDELINES FOR LIVE ELECTRICAL WORK PERMIT

1. The permit shall be issued in triplicate.

Copy 1 (Colour)	To be held with On-site Work Supervisor
Copy 2 (Colour)	To be displayed at on-site Notice Board
Copy 3 (Colour)	To be submitted to EHS Executive

2. The duration of the permit shall be for one shift unless work continues beyond that shift with the same personnel.

3. However, any work required to be done beyond the permitted hours shall be done with a permit extension approval from the Supervisor obtained 30 minutes before the permit expiry time.

4. For extension all three copies must be signed by concerned authority specifying the reason for extension.

5. All work must be done between 8.30 AM and 5.30 PM. Any work to be done beyond 5.30 PM shall also require a permit extension taken 30 minutes in advance from Supervisor.

6. Ensure proper illumination in case of night work.

7. The authorized person of electrical department shall check the relevant points mentioned in the work permit & ensure the equipment free from the electrical hazard.

8. The authorized person of Mechanical department shall check the necessary points mentioned in the work permit & ensure the equipment free from the Mechanical hazard.

9. The Supervisor shall verify whether all the necessary conditions mentioned in the permit are complied & safe to do the job.

10. It shall be the responsibility of the concerned department in-charge to maintain the conditions of the area throughout the work as checked during the duration of permit.

11. The separate work permit (Confined Space Entry Permit, Elevated Work Permit etc.) shall be obtained if any other hazardous wok is involved.

12. After completion of the job do proper housekeeping.

13. After the completion of the work, the permit shall be promptly closed and submitted to Supervisor.

HOT WORK PERMIT

Permit S/N: _____
Date: _____

SECTION A

Facility ID: Work Location:	Work Description with associated Hazards::
Permit Issued to:	Name & Signature of Indenter: _____ Designation: _____
Permit Duration:	(STARTS) Date :_____ Time:_____ / (ENDS) Date :_____ Time:_____
Any Additional Permit Required? (Give details)	_____ _____ _____

SECTION B

REQUIRED PPE		EQUIPMENT & MAN-POWER		WORK SITE PREPARATIONS	
Eye Protection	☐	Safety Barriers	☐	Posting of Warning Signs	☐
Ear Protection	☐	Warning Lines/Caution Signs	☐	Removal of Obstructions	☐
Coverall	☐	Ventilation Equipment	☐	Limit Access to Site & Securing Area	☐
Apron	☐	Communication Equipment	☐	Inspection of Equipments and Tools	☐
Safety Gloves	☐	Rescue Equipment	☐	Fire Fighting & Rescue Equipment	☐
Hard Hat	☐	Fire Fighting Equipment	☐	Safety Meeting	☐
Safety Shoes	☐	Tools & Equipments for Work	☐	Establishing Communication	☐
Face Shield	☐	Mobile Access Platforms	☐	Mechanical Isolation	☐
Personal Fall Arrest Syt.	☐	Health & Safety Executive	☐	Electrical Isolation	☐
Breathing Apparatus	☐	Fire Watch	☐	Clearing Flammables & Combustibles	☐
Grounded Elec. Equip	☐	Supervisor	☐	Atmospheric Gas Tests	☐
Port. Gas Detectors	☐	Attendant	☐	Ventilation	☐

Special Precautions:

SECTION C

Electric Isolation Details	Signature of person who isolates
Mechanical Isolation Details	Signature of person who isolates
Results of Atmospheric Tests:	Signature of person who performs testing

	Limit	Pre Entry	Time: _____	Time: _____	Time: _____	Time: _____	Instrument Details: Type	S/N:	Calib.Date
Oxygen	19.5-23.5 (%)								
LEL	<10%								
CO	<25ppm								
H_2S	<10ppm								
Others:									

SECTION D

I have reviewed this permit and I am fully aware of the hazards and precautions necessary for the performing the designated work authorized by this permit. I shall be responsible for all the workers involved in this designated work and their adherence to the provisions of this permit program.

_____
Name & Signature of Indenter/ Supervisor

Names of Authorized Workers

1. _____ **2.** _____ **3.** _____
4. _____ **5.** _____ **6.** _____
7. _____ **8.** _____ **9.** _____

SECTION E

I confirm that all necessary precautions have been taken to perform the work safely:

Name /Sign. of **EHS Executive:** _____ Date/Time: _____ @ _____ Hrs

Name /Sign. of **Plant Area Supervisor:** _____Date/Time: _____ @ _____ Hrs

I confirm that all precautions and safety measures are in place & the work can be permitted to be carried out:

Name:_____ Date:_____
Signature:_____Designation:_____

		Time:_____ _	
Permit Extension up to :	(Date & Time) _____ ___	(Reason for Extension) _____ _____	**SECTION**
Name & Signature_____		**Designation**_____ _	
Work Completed? ☐ Worksite Returned to Normal? ☐ Isolated Equipment De-isolated ☐ **Permit Closed**? ☐	**Checked & Found OK**	Signature/Time (PAI): _____@ _____Hrs Signature/Time (EHS):_____@ _____Hrs	

GUIDELINES FOR HOT WORK PERMIT

1. The permit shall be issued in triplicate.

Copy 1 (Colour)	To be held with On-site Work Supervisor
Copy 2 (Colour)	To be displayed at on-site Notice Board
Copy 3 (Colour)	To be submitted EHS Executive

2. The duration of the permit shall be for one shift unless work continues beyond that shift with the same personnel.

3. However, any work required to be done beyond the permitted hours shall be done with a permit extension approval from the Supervisor obtained 30 minutes before the permit expiry time.

4. For extension all three copies must be signed by concerned authority specifying the reason for extension.

5. All work must be done between 8.30 AM and 5.30 PM. Any work to be done beyond 5.30 PM shall also require a permit extension taken 30 minutes in advance from Supervisor.

6. Ensure proper illumination in case of night work.

7. The authorized person of electrical department shall check the relevant points mentioned in the work permit & ensure the equipment free from the electrical hazard.

8. The authorized person of Mechanical department shall check the necessary points mentioned in the work permit & ensure the equipment free from the Mechanical hazard.

9. The Supervisor shall verify whether all the necessary conditions mentioned in the permit are complied & safe to do the job.

10. It shall be the responsibility of the concerned department in-charge to maintain the conditions of the area throughout the work as checked during the duration of permit.

11. Respective department shall depute a company employee trained in fire fighting who shall be constantly present at the hot work site as a fire watcher till the completion of the work.

12. The separate work permit (Confined Space Entry Permit, Elevated Work Permit etc.) shall be obtained if any other hazardous wok is involved.

13. After completion of the job do proper housekeeping.

14. After the completion of the work, the permit shall be promptly closed and submitted to Supervisor.

CONFINED SPACE ENTRY PERMIT

Permit S/N: _____
Date: _____

SECTION A

Facility ID: Location:	Purpose of Entry and associated Hazards **:**
Permit Issued to:	Name & Signature of Indenter: _____ Designation: _____
Permit Duration:	(STARTS) Date :_____ Time:_____ / (ENDS) Date :_____ Time:_____
Any Additional Permit Required? (Give details)	_____ _____ _____

SECTION B

REQUIRED PPE		**EQUIPMENT & MAN-POWER**		**WORK SITE PREPARATIONS**	
Eye Protection	☐	Warning Lines/Caution Signs	☐	Posting of Warning Signs	☐
Ear Protection	☐	Barricades	☐	Limit Access to Site & Securing Area	☐
Protective Clothing	☐	Ventilation Equipment	☐	Inspection of Equipments and Tools	☐
Apron	☐	Communication Equipment	☐	Cleaning & Washing	☐
Safety Gloves	☐	Rescue Equipment	☐	Clearing Flammables & Combustibles	☐
Hard Hat	☐	Fire Fighting Equipment	☐	Atmospheric Gas Tests	☐
Foot Protection	☐	Tools & Equipments for Work	☐	Electrical Isolation	☐
Face Shield	☐	Mobile Access Platforms	☐	Mechanical Isolation	☐
Retrieval Line/ Hoist	☐	Health & Safety Executive	☐	Ventilation	☐
Breathing Apparatus	☐	Entry Supervisor	☐	Establishing Communication	☐
Safety Harness	☐	Attendant	☐	Safety Meeting	☐
Port. Gas Detectors	☐	Backup Attendant	☐	Others	☐

Special Precautions:

SECTION C

Electric Isolation Details	Signature of person who isolates
Mechanical Isolation Details	Signature of person who isolates
Results of Atmospheric Tests:	Signature of person who performs testing

	Limit	**Pre Entry**	**Time:** _____ _	**Time:** _____ _	**Time:** _____	**Time:** _____ _	**Instrument Details**		
							Type	**S/N:**	**Calib.Date**
Oxygen	19.5-23.5 (%)								
LEL	<10%								
CO	<25ppm								
H_2S	<10ppm								
Others:									

SECTION D

I have reviewed this permit and I am fully aware of the hazards and precautions necessary for the performing the designated work authorized by this permit. I shall be responsible for all the workers involved in this designated work and their adherence to the provisions of this permit program.

_____
Name & Signature of Indenter/ Supervisor

Names of Authorized Workers

1._____ **2.**_____ **3.**_____
___ ___ ___

4._____ **5.**_____ **6.**_____
___ ___ ___

SECTION E

I confirm that all necessary precautions have been taken to perform the work safely:

Name /Sign. of **EHS Executive:** _____ Date/Time: _____ @ _____ Hrs

Name /Sign. of **Plant Area Supervisor:** _____Date/Time: _____ @ _____ Hrs

I confirm that all precautions and safety measures are in place & the work can be permitted to be carried out:

Name:_____ Date:_____
_
Signature:_____Designation:_____ Time:_____
_

Permit Extension up to :	(Date & Time) _____ ___	(Reason for Extension) _____ _____	**SECTION F**
Name & Signature_____**Designation**_____ _			
Work Completed? Worksite Returned to Normal? Isolated Equipment De-isolated **Permit Closed**?	☐ ☐ ☐ ☐	**Checked & Found OK**	Signature/Time (PAI): _____@ _____Hrs Signature/Time (EHS):_____@ _____Hrs

GUIDELINES FOR CONFINED SPACE ENTRY PERMIT

1. The permit shall be issued in triplicate.

Copy 1 (Colour)	To be held with On-site Work Supervisor
Copy 2 (Colour)	To be displayed at on-site Notice Board
Copy 3 (Colour)	To be submitted to EHS Executive

2. The duration of the permit shall be for one shift unless work continues beyond that shift with the same personnel.

3. However, any work required to be done beyond the permitted hours shall be done with a permit extension approval from the Supervisor obtained 30 minutes before the permit expiry time.

4. For extension all three copies must be signed by concerned authority specifying the reason for extension.

5. All work must be done between 8.30 AM and 5.30 PM. Any work to be done beyond 5.30 PM shall also require a permit extension taken 30 minutes in advance from Supervisor.

6. Ensure proper illumination in case of night work.

7. The authorized person of electrical department shall check the relevant points mentioned in the work permit & ensure the equipment free from the electrical hazard.

8. The authorized person of Mechanical department shall check the necessary points mentioned in the work permit & ensure the equipment free from the Mechanical hazard.

9. The Supervisor shall verify whether all the necessary conditions mentioned in the permit are complied & safe to do the job.

10. It shall be the responsibility of the concerned department in-charge to maintain the conditions of the area throughout the work as checked during the duration of permit.

11. The separate work permit (Confined Space Entry Permit, Elevated Work Permit etc.) shall be obtained if any other hazardous wok is involved.

12. After completion of the job do proper housekeeping.

13. After the completion of the work, the permit shall be promptly closed and submitted to Supervisor.

Annexure B

Incident Investigation Form

Accident/Incident Investigation Form

GILBARCO VEEDER-ROOT	**TITLE:- Accident/Incident Investigation Form**	**Issue/No**	
		Format No:-	
		Page No	

Instruction: This form must be completed by the member of OH&S committee whenever an accident/incident occurs. The assistant manager or authorized designate for the department will be responsible for completing this form in the absence of the member of OH&S committee. The department manager must ensure a copy of the completed report is forwarded to the Human Resources Manager, and the Safety Officer.

Check an Accident/incident resulted in:

□ Injury □ Illness □ Property Damage □ Near Miss □ First Aid □ Medical aid □ Recurrence □ Vehicle incident □ Fire □ Spill □ Explosion □ Journey injury □ Community complaint □ Security Breach □ other (check all that apply)

Location	Department	
Location of Incident (Be specific – eg. aisle 10)	Date of incident Time_____ am pm	Date reported accident/incident

ACCIDENT/INCIDENT INFORMATION

Supervisor:_____ Date of first missed shift:_____ No. of days lost_____

Approximate date of onset, if no specific date of injury:_____

Object/equipment/substance inflicting damage/injury:_____

Nature of injury:_____ Body part(s) affected:_____

EMPLOYEE INFORMATION

Name (last name first – please print)

_____ Home phone number:_____

Home Address:_____ Age: _____ Sex: M / F

_____

_____

Date of employment:_____ Occupation/Position: _____

Experience (time) in job:_____

Evaluation of loss Potential if not corrected	Loss severity potential □ Major □ Serious □ Minor	Probability of occurrence □ High □ Moderate □ Low

Describe how the event occurred.

Immediate causes: What substandard acts/practices and conditions caused or could cause the event? See end of form.

Basic causes: What specific personal or job/system factors caused or could cause this event? See end of form.

Remedial actions: What has and/or should be done to control the causes listed?

Prevention of Accident/Incident Recurrence

Describe what action is planned or has been taken to prevent a recurrence of the accident, based on the key contributing factors

(immediate)

(long term)

Signed by Supervisor_____ Supervisor's Name _____

Signed by Person Involved:_____	Signed by HR:_____
Signed by Safety Officer r:_____	Date: _____

REPORT FORM DEFINITIONS
INJURY – physical harm or damaged to a person. ILLNESS – unhealthy condition in mind or body. FIRST AID INJURY – a minor injury requiring only first aid treatment. MEDICAL AID INJURY – an injury requiring treatment by a health care professional. LOST TIME INJURY – a disabling injury where the injured person is unable to report for the next regular shift. RECURRENCE – an accident or incident which has occurred more than once. PROPERTY DAMAGE ACCIDENT – accidental loss to equipment, material, and/or the environment. INCIDENT (NEAR-MISS) – an undesired event that, under slightly different circumstances, could have resulted in personal injury, prope or loss.

IMMEDIATE CAUSES – check all as appropriate	
Substandard Acts/Actions	Substandard Conditions
☐Operating equipment without authority	☐Inadequate guards or barriers
☐Failure to warn	☐Inadequate or improper protective equipment
☐Failure to secure	☐Defective tools, equipment or materials
☐Operating at improper speed	☐Congestion or restricted action
☐Making safety devices inoperable	☐Inadequate warning system
☐Removing safety devices	☐Fire and explosion hazard
☐Using defective equipment	☐Poor housekeeping, disorder
☐Failure to use PPE	☐Hazardous environmental conditions, gases, smoke, dusts, fumes
☐Improper loading	☐Noise exposure
☐Improper placement	☐Radiation exposure
☐Improper lifting	☐High or low temperature exposure
☐Improper position for task	☐Inadequate or excess illumination
☐Servicing equipment in operation	☐Inadequate ventilation
☐Horseplay	
☐Under influence of alcohol and/or other substances	

BASIC CAUSES – check all as appropriate	
Personal Factors	Job Factors
☐Inadequate capability	☐Inadequate leadership/supervision
☐Lack of knowledge/training	☐Inadequate engineering
☐Lack of skill	☐Inadequate purchasing
☐Stress	☐Inadequate maintenance
☐Improper motivation	☐Inadequate tools/equipment
	☐Inadequate work standards
	☐Wear and Tear
	☐Abuse and/or misuse

	☐Permit not obtained

Annexure C

Template for Health & Safety Reporting

Name of the Facility:_____

Address:_____

_____

Checkpoints for Health & Safety Reporting

Particular	Observation	Recommendation	Status
Emergency management			
Hazardous Operations			
Work at height			
Electrical works			
Hot works			
Confined space entry			
Occupational health			
Community Health and Safety			
Management and control of hazardous energy			

Annexure XX

Run File and Model Output - ALOHA

```
SITE DATA:
  Location: ASHUGANJ, BANGLADESH
  Building Air Exchanges Per Hour: 0.56 (unsheltered single storied)
  Time: May 26, 2015  1230 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: METHANE                    Molecular Weight: 16.04 g/mol
  PAC-1: 2900 ppm    PAC-2: 2900 ppm        PAC-3: 17000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -161.6° C
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3.5 knots from S at 3 meters
  Ground Roughness: open country            Cloud Cover: 0 tenths
  Air Temperature: 37° C                    Stability Class: B
  No Inversion Height                       Relative Humidity: 71%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 10 inches                   Pipe Length: 910 meters
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                     Hole Area: 78.5 sq in
  Pipe Press: 70 psia                        Pipe Temperature: 37° C
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 484 kilograms/min
     (averaged over a minute or more)
  Total Amount Released: 27,791 kilograms

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Overpressure (blast force) from vapor cloud explosion
  Type of Ignition: ignited by spark or flame
  Level of Congestion: congested
  Model Run: Gaussian
  Red   : LOC was never exceeded --- (8.0 psi = destruction of buildings)
  Orange: LOC was never exceeded --- (3.5 psi = serious injury likely)
  Yellow: 76 meters --- (1.0 psi = shatters glass)
```

Overpressure (Blast Force) Threat Zone

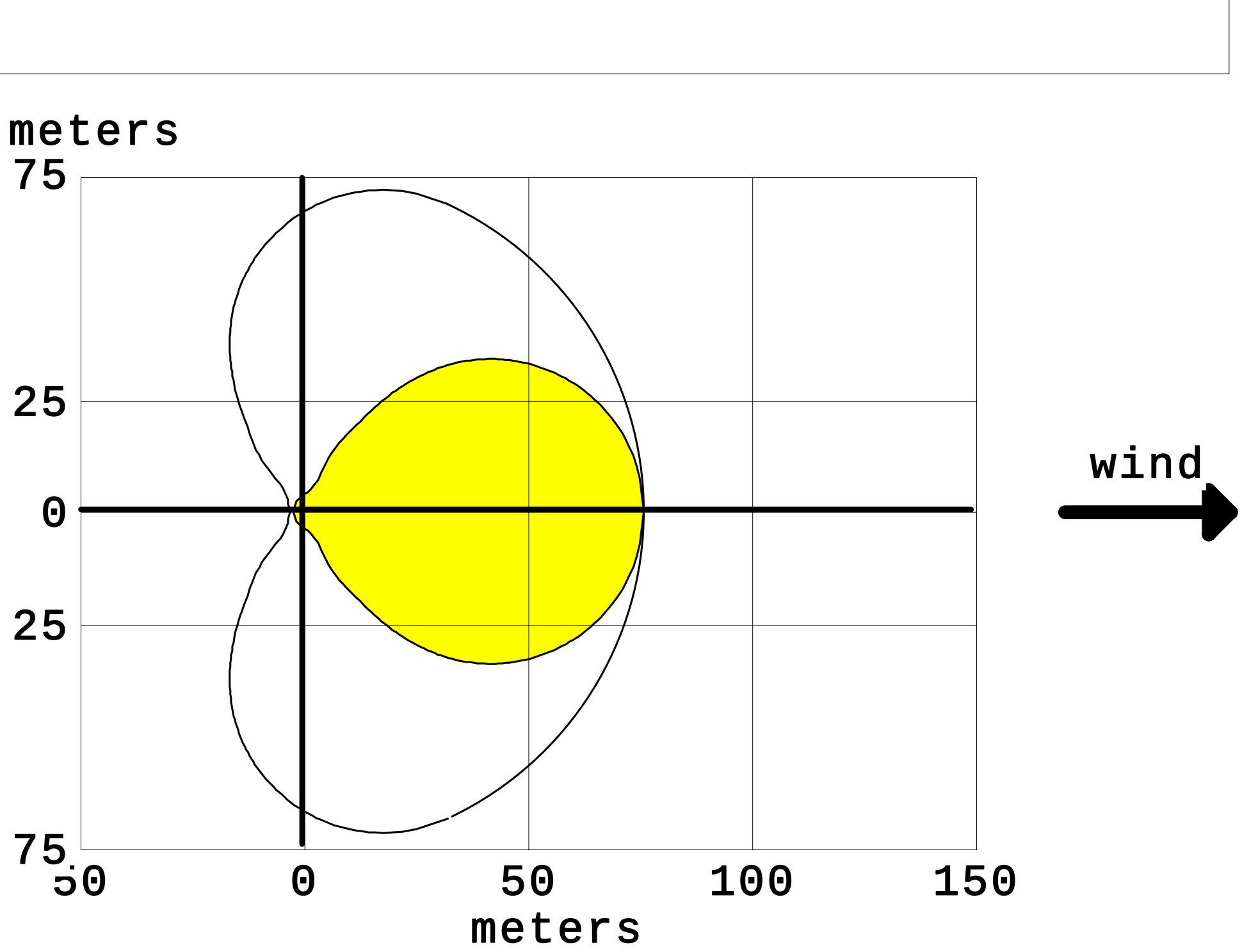
ALOHA® 5.4.4

```
Time: May 26, 2015  1230 hours ST (user specified)

Chemical Name: METHANE

Wind: 3.5 knots from S at 3 meters

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Overpressure (blast force) from vapor cloud explosion
  Type of Ignition: ignited by spark or flame
  Level of Congestion: congested
  Model Run: Gaussian
  Red   : LOC was never exceeded --- (8.0 psi = destruction of buildings)
  Orange: LOC was never exceeded --- (3.5 psi = serious injury likely)
  Yellow: 76 meters --- (1.0 psi = shatters glass)
```



```
SITE DATA:
  Location: ASHUGANJ, BANGLADESH
  Building Air Exchanges Per Hour: 0.56 (unsheltered single storied)
  Time: May 26, 2015  1230 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: METHANE                    Molecular Weight: 16.04 g/mol
  PAC-1: 2900 ppm    PAC-2: 2900 ppm        PAC-3: 17000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -161.6° C
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3.5 knots from S at 3 meters
  Ground Roughness: open country            Cloud Cover: 0 tenths
  Air Temperature: 37° C                    Stability Class: B
  No Inversion Height                       Relative Humidity: 71%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 10 inches                   Pipe Length: 910 meters
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                     Hole Area: 78.5 sq in
  Pipe Press: 70 psia                        Pipe Temperature: 37° C
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 484 kilograms/min
     (averaged over a minute or more)
  Total Amount Released: 27,791 kilograms

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red   : 68 meters --- (50000 ppm = LEL)
  Orange: 88 meters --- (30000 ppm = 60% LEL = Flame Pockets)
  Yellow: 217 meters --- (5000 ppm = 10% LEL)
```

Flammable Threat Zone

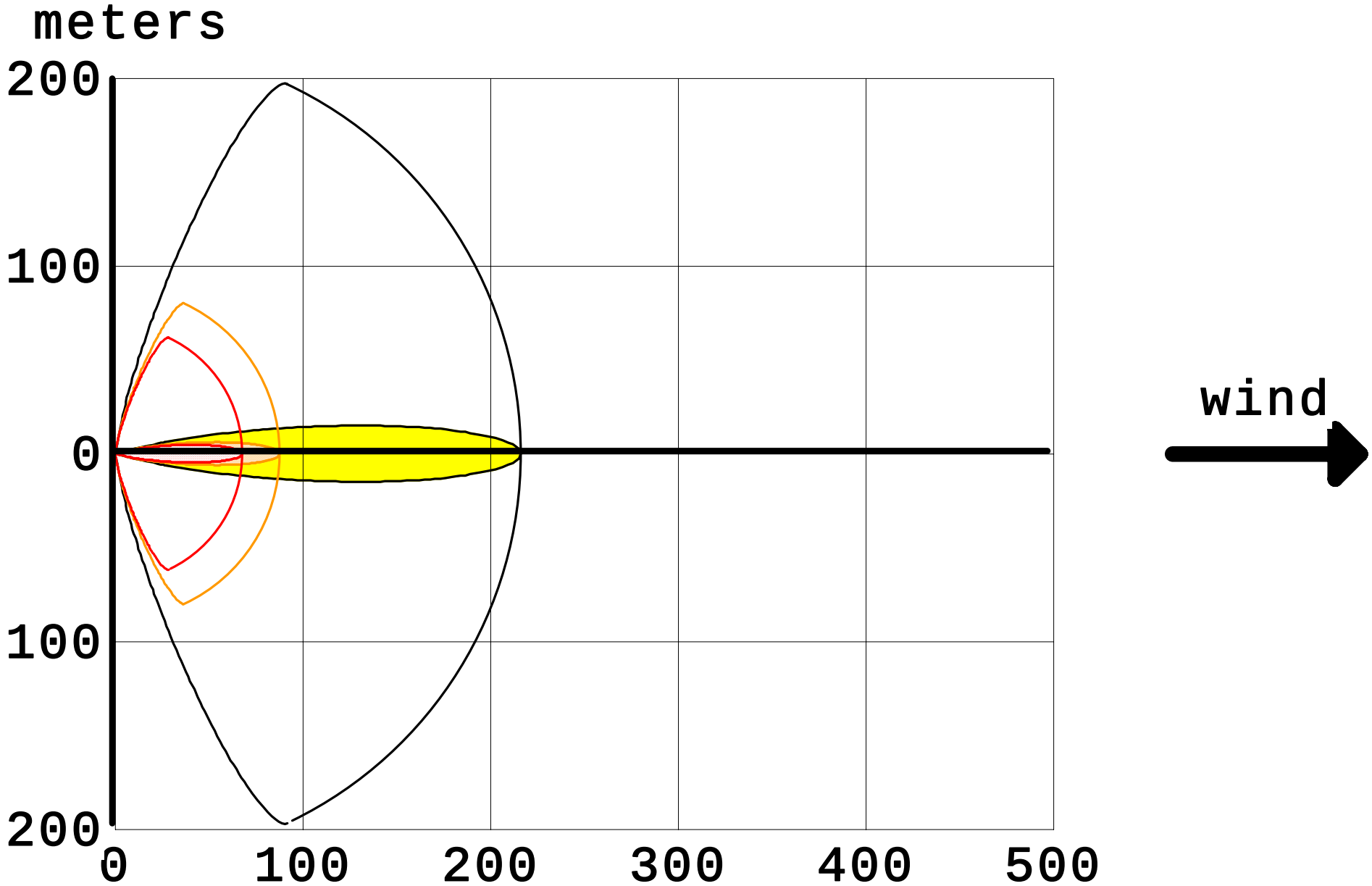
ALOHA® 5.4.4

```
Time: May 26, 2015  1230 hours ST (user specified)

Chemical Name: METHANE

Wind: 3.5 knots from S at 3 meters

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red   : 68 meters --- (50000 ppm = LEL)
  Orange: 88 meters --- (30000 ppm = 60% LEL = Flame Pockets)
  Yellow: 217 meters --- (5000 ppm = 10% LEL)
```



meters

greater than 50000 ppm (LEL)

greater than 30000 ppm (60% LEL = Flame

greater than 5000 ppm (10% LEL)

wind direction confidence lines

```
SITE DATA:
  Location: ASHUGANJ, BANGLADESH
  Building Air Exchanges Per Hour: 0.56 (unsheltered single storied)
  Time: May 26, 2015  1230 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: METHANE                    Molecular Weight: 16.04 g/mol
  PAC-1: 2900 ppm    PAC-2: 2900 ppm        PAC-3: 17000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -161.6° C
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3.5 knots from S at 3 meters
  Ground Roughness: open country            Cloud Cover: 0 tenths
  Air Temperature: 37° C                    Stability Class: B
  No Inversion Height                       Relative Humidity: 71%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 10 inches                  Pipe Length: 910 meters
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                    Hole Area: 78.5 sq in
  Pipe Press: 70 psia                       Pipe Temperature: 37° C
  Max Flame Length: 20 meters
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 1,930 kilograms/min
  Total Amount Burned: 27,791 kilograms

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red   : 20 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 33 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 53 meters --- (2.0 kW/(sq m) = pain within 60 sec)
```

Thermal Radiation Threat Zone

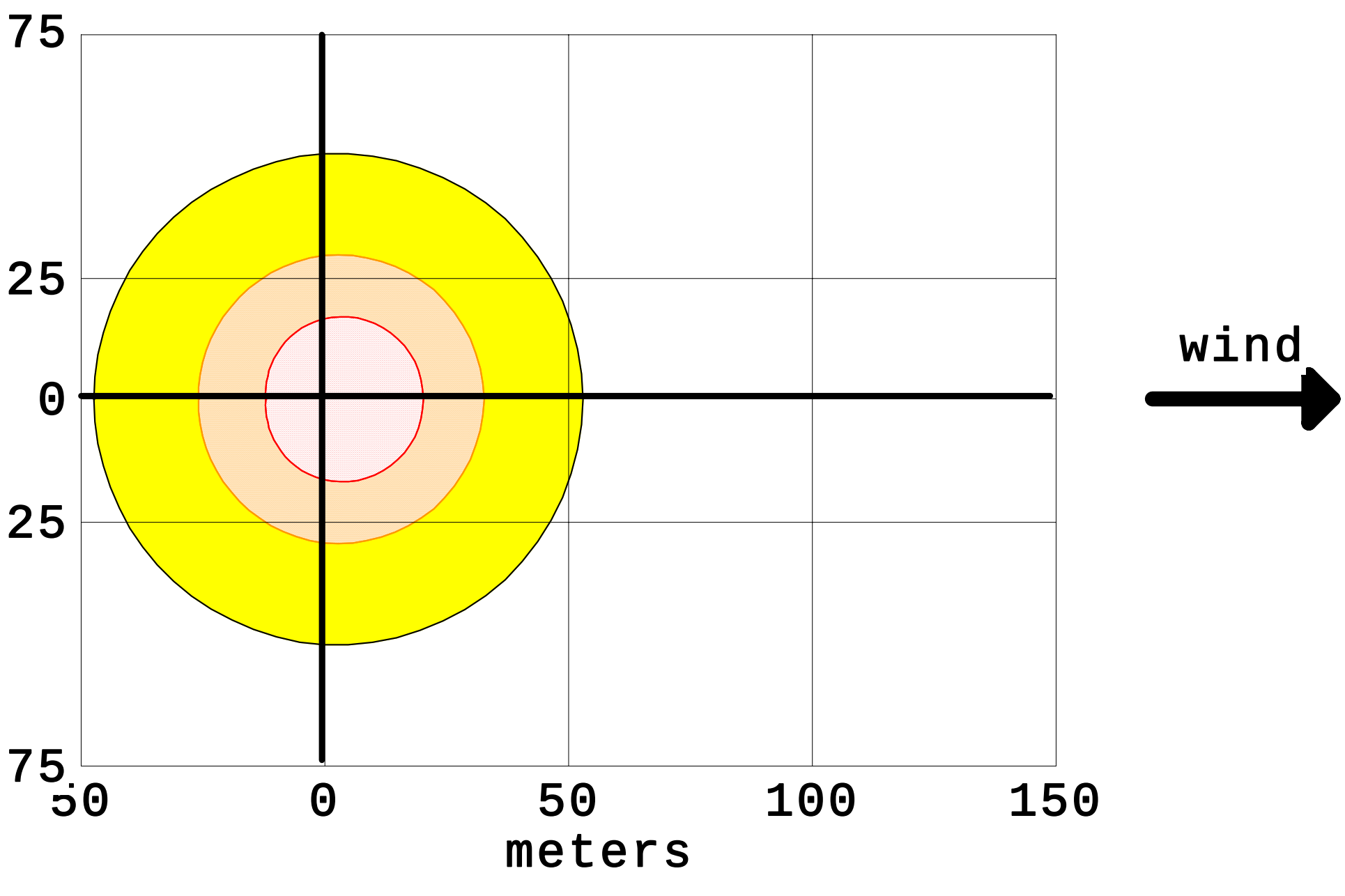
ALOHA® 5.4.4

```
Time: May 26, 2015  1230 hours ST (user specified)

Chemical Name: METHANE

Wind: 3.5 knots from S at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red   : 20 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 33 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 53 meters --- (2.0 kW/(sq m) = pain within 60 sec)
```



greater than 10.0 kW/(sq m) (potentially leth
greater than 5.0 kW/(sq m) (2nd degree burns
greater than 2.0 kW/(sq m) (pain within 60 se